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New locality of *Orthochirus innesi* Simon, 1910 in Algeria (Scorpiones: Buthidae)

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Abstract

This note concerns a small scorpion and a little-known buthid species *Orthochirus innesi* Simon, 1910. According to the last work about scorpions of Algeria in 2018, this species is located in Algerian Septentrional Sahara at the East of Algeria. This finding provides a new locality of *O. innsi* outside this geographical distribution range, of which it is extended about 200 km to the central of Algeria (Ghardaïa). This new locality is a palm groves of Zelfana, confirming that *O. innesi* from Algeria has an affinity to shady and humid area.

Keywords: Scorpion, *Orthochirus innesi*, Septentrional Sahara, Algeria.

Introduction

The genus *Orthochirus* Karsch, 1891 actually counts 52 valid named species (Rein, 2020). Two species have clearly been reported from Africa, *O. aristidis* (Simon, 1882) and *O. innesi* Simon, 1910. The first species *O. aristidis* is distributed in the South of Egypt, Sudan, Djibouti and possibly Ethiopia (Vachon, 1952; Levy & Amitai, 1980; El-Hennawy, 1992, Lourenço & Leguin, 2011). However, many works indicated that *O. innesi* Simon, 1910 can be found in large band of North Africa and even Middle East. It was reported for the first time from Morocco in 1995 at the edge of Sahara Desert (Kovařík, 1995).

In Lourenço & Leguin (2011), three species were added to this genus in North Africa: *O. atarensis* Lourenço & Leguin, 2011 from Mauritania, *O. cloudsleythompsoni* Lourenço & Leguin, 2011 from Morocco and *O. tassili* Lourenço & Leguin, 2011 from Algeria. According to this reference, the distribution of *O. innesi* begins from Egypt to south Tunisia with a question mark on its distribution in Algeria.

Many recent works of Sadine and his co-authors proved the existence of this species in several localities in Septentrional Sahara of East Algeria (Sadine, 2005; Sadine *et al.*, 2011; Sadine, 2012; Sadine & Bissati, 2014; Sadine, 2018; Sadine *et al.*, 2018). Although, Sadine *et al.* (2014), Lahrech & Souilem (2017), Sadine (2018), and Bengaid (2018) indicated the absence of this species in central of Algeria (Ghardaïa).

Our finding provides a new locality of *O. innesi* in this region outside the geographical distribution range about 200 km to the central of Algeria, based on two specimens recently collected from palm groves of Zelfana.

Material and Methods

Study area

The region of Ghardaïa is located in the central of Algeria (Fig. 1A) at an average altitude of the main reliefs of 520 metres. Geomorphological features are constituted by the Wadis and the Regs (Benkenzou *et al.*, 2007).

The region is characterized by a dry Saharan climate with extreme thermal amplitudes between the day and the night; the coldest month is January with a minimal temperature of 6ºC, whereas the hottest month is July with a maximum temperature of 41ºC (Sam, 2012).

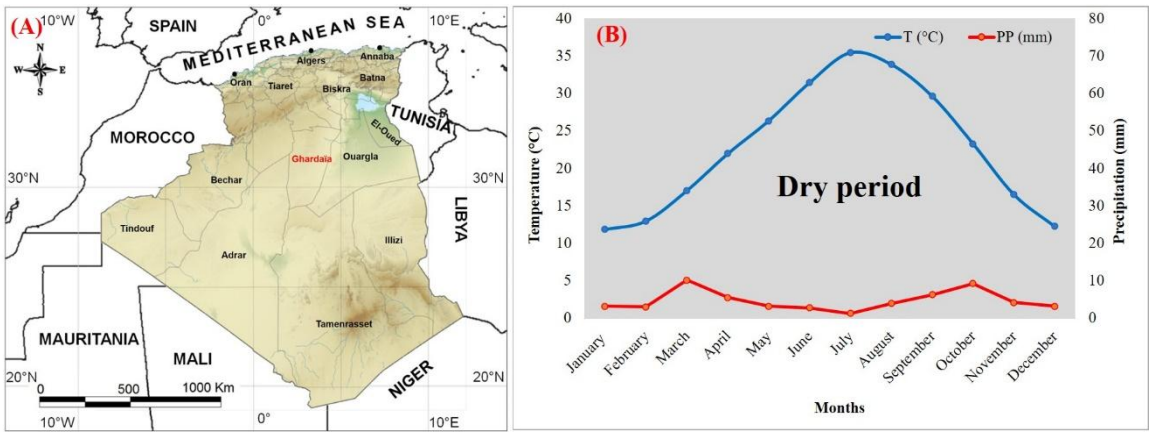

Fig. 1. Description of study area. A. Map of Algeria showing the region of Ghardaïa. B. Ombrothermic diagram of Bagnouls and Gaussen (Ghardaïa: 2010-2019).

Concerning Rain fall, it is extremely low in this region with an average value of 80 mm per year. Air humidity is rather weak with a maximum value of 55% in December and a minimum of 21% in July (Chehma, 2011). Analysis of dry periods over ten years attest that the drought period spans almost all twelve months of the year (Fig. 1B).

Material examined

The present note is based on two female specimens (2 ♀♀) collected from central Algeria, Region of Ghardaïa, Zelfana (32°42'N, 04°22'E), in palm groves, 03/III/2020 (S.E. Sadine). Material is deposited in Laboratory of Zoology, University of Ghardaïa, Algeria.

Fig. 2. *Orthochirus innesi* (♀) alive in natural environment.

Description

Medium sized scorpions, never exceed 35 mm. with a dark colour (ranging from reddish-brown to black) (Fig. 2). Chelicerae yellowish to reddish-yellow; base of fingers blackish; fingers reddish-brown. Legs reddish-yellow with three distal segments yellowish (Lourenço & Leguin, 2011). Fixed and movable fingers with 8 rows of denticles. Pectinal teeth in females count 15-16.

Fig. 3. Palm groves of Zelfana, a natural biotope of *Orthochirus innesi* in the study area.

Ecological and geographical considerations

O. innesi is very little-known and a very little work has been done on the ecology of this species. Vachon (1952) classified it as oasis scorpion. Because it prefers shady and humid area. This species is ranged as hygrophilous species (Sadine, 2005; Sadine, 2012; Sadine & Bissati, 2014; Sadine, 2018; Sadine *et al.,* 2018). However, in Morocco, *O. innesi* is limited to areas with loamy, clayey soils (pelophilous species), sandy, and earthy habitats. It is classifying as a non-opportunistic species because it is not plastic and environmentally shows strict respect to the nature of the substratum requirements (El

Hidan *et al.*, 2016). Recently, Touloun (2019) confirmed that this species is known from the oases of the Anti-Atlas and the Drâa valley (Morocco).

In Algerian Septentrional Sahara, this species is represented with abundance less than 5% in the palm groves of East Algeria (Sadine, 2005; Sadine *et al.*, 2011; Sadine, 2012; Sadine & Bissati, 2014; Sadine, 2018; Sadine *et al.*, 2018). Contrariwise, this species, was not reported in central of Algeria, especially in Ghardaïa (Sadine *et al.*, 2014; Lahrech & Souilem, 2017; Sadine, 2018; Bengaid, 2018).

In this work, two specimens of *O. innesi* were found in palm groves of Zelfana (Fig. 3) outside the geographical distribution range indicated in Sadine (2018), of which it is extended about Ghardaïa 200 km to the central of Algeria.

According to the last repartition of *O. innesi* in Algerian Septentrional Sahara and the new locality indicated in the present work. The current distribution of *O. innesi* can be summarized in Fig. (4).

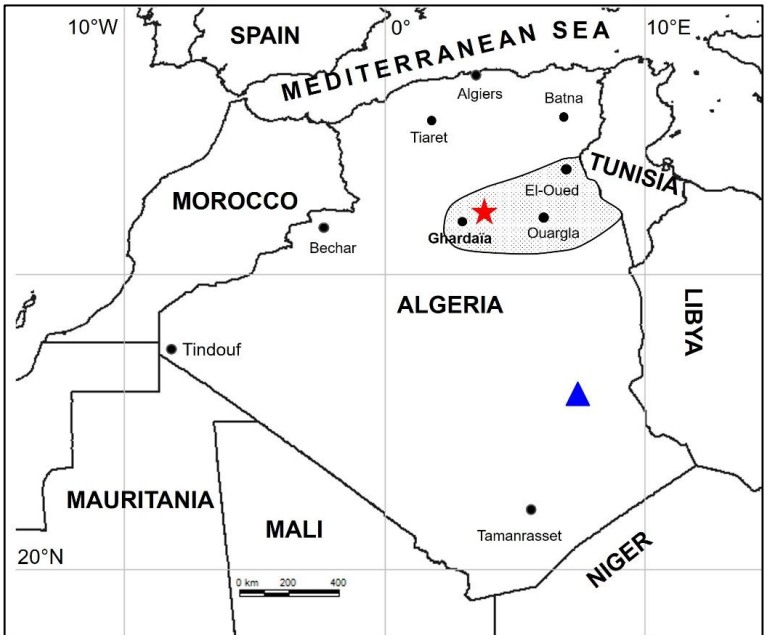

Fig. 4. Map of the present geographical distribution range of *Orthochirus innesi* in Algeria (dashed area). New locality (red star). *Orthochirus tassili* (blue triangle).

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Description of the female of *Buthus aures* Lourenço & Sadine, 2016 (Scorpiones: Buthidae), with its current distribution in East Algeria

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Abstract

Buthus aures Lourenço & Sadine, 2016 was described from the type locality Batna (North-East Algeria) based on two male specimens. This note presents the description of a female recently collected from Tebessa region, situated at 220 km east form the type locality and a morphological comparison between this species and the other *Buthus* species distributed in the north-east of Algeria and Tunisia. Among the important results in this work is the expansion of the geographical distribution of *B. aures* to reach the neighbouring regions such as Khenchla and Tebessa. Some ecological remarks of *B. aures* are also included.

Keywords: Scorpion, *Buthus aures*, distribution, Ecological consideration, Algeria.

Introduction

The genus *Buthus* Leach, 1815 belongs to the most speciose and widespread scorpion family, Buthidae C.L. Koch 1837, with 59 valid named species (Rein, 2020) distributed in 26 countries: 17 in Africa, five countries in Asia, and four European countries, in addition to other countries with uncertain *Buthus* species records (Sousa *et al*., 2017).

Algeria has eight confirmed *Buthus* species: *B. tunetanus* (Herbst, 1800), *B. paris* (C.L. Koch, 1839), *B. tassili* Lourenço, 2002, *B. pusillus* Lourenço, 2013, *B. saharicus* Sadine, Bissati & Lourenço, 2016, *B. aures* Lourenço & Sadine, 2016, *B. boussaadi* Lourenço, Chichi & Sadine, 2018, and *B. apiatus* Lourenço, El Bouhissi & Sadine, 2020.

Sadine *et al.* (2012) cited the *Buthus* of National Park of Belezma (Batna) as *Buthus occitanus* (Amoreux, 1789) because it seems different from *B. tunetanus* and *B. paris*. Pedroso *et al.* (2013) based on DNA analyses (a multigene molecular approach) in the Maghreb mentioned that the *Buthus* sampled from National Park of Belezma (Batna-Algeria) (Id. Sc0403) is situated in the out group (in the graphic Fig. 2), it is probably a new species or can be a case of vicariance. Lourenço & Sadine (2016) morphologically confirmed that *Buthus* from National Park of Belezma (Batna) can be ranged as a new species named *Buthus aures* Lourenço & Sadine, 2016.

The description of *B. aures* was based only on two male specimens from the type locality Batna (East Algeria). This work, is an amendment to the knowledge of this species, representing a description of the female of *Buthus aures* recently collected from Tebessa region, east of the type locality, and a morphological comparison with a male paratype deposited in the University of Ghardaïa (Algeria), with some ecological remarks on current distribution of *B. aures*.

Material and Methods

Material examined: New locality: Algeria, region of Tebessa (Fig. 2A), Safsaf El-Ouesra (220 km east of the type locality), one female, 05/VII/2019, in mountain formation (34º57'N, 08º12'E), 860-920 m, (H. Abidi). Male paratype. Examined specimens are deposited in the Laboratory of Zoology, University of Ghardaïa, Algeria. Identification was obtained using a stereo-microscope as described by Vachon (1974).

Fig. 1. Female *Buthus aures* in natural habitat in mountain formation of Tebessa (Algeria).

Study area (Region of Tebessa)

The region of Tebessa is located in the Oriental region of Algeria (Fig. 2B), between 6 and 8 degrees of longitude and 34 and 36 degrees of latitude. The relief in the area basically composed of medium and a high plain which reaches 600-1000 m (B.N.E.D.E.R., 2007).

The climate in this region can vary from semi-arid cool to almost semi-arid. Precipitations can range from 10 to 15 mm in July to 52 mm in September. The sum of precipitations during the year can reach 380 mm (O.N.M, 2010).

Taxonomic situation of the studied species

Family **Buthidae** C.L. Koch 1837
Genus ***Buthus*** Leach, 1815
Buthus aures Lourenço & Sadine, 2016 (Fig. 1, Table 1)

Diagnosis

Scorpion of moderate to large size (male paratype 60.0; female 62.8); General colouration orange-yellowish; carapace and tergites moderately spotted; Carinae and granulations strongly marked. Fixed and movable fingers with 11-12 rows of granules. Pectines with 30-31 teeth in male paratype and 27-28 teeth in female.

Morphometric values

Table 1. Morphometric values (in mm) of male paratype and female of *Buthus aures*.

Buthus aures	**Male paratype**	**Female**
Total length (telson included)	60.0	62.8
Carapace:		
- length	6.2	7.2
- anterior width	4.5	3.4
- posterior width	6.3	8.1
Mesosoma length:	15.8	20.7
Metasomal segment I:		
- length	4.3	4.3
- width	3.9	4.6
Metasomal segment II:		
- length	5.5	5.1
- width	4.3	4.5
Metasomal segment III:		
- length	5.8	5.4
- width	4.4	4.4
Metasomal segment IV:		
- length	6.8	6.3
- width	4.9	4.3
Metasomal segment V:		
- length	8.7	7.2
- width	4.7	4.2
Telson:		
- length	7.1	6.4
Pedipalp:		
- Femur length	5.2	5.6
- Femur width	1.6	1.7
- Patella length	6.6	6.3
- Patella width	1.8	2.4
- Chela length	11.4	11.9
- Chela width	3.0	3.2
Movable finger:		
- length	7.3	6.9

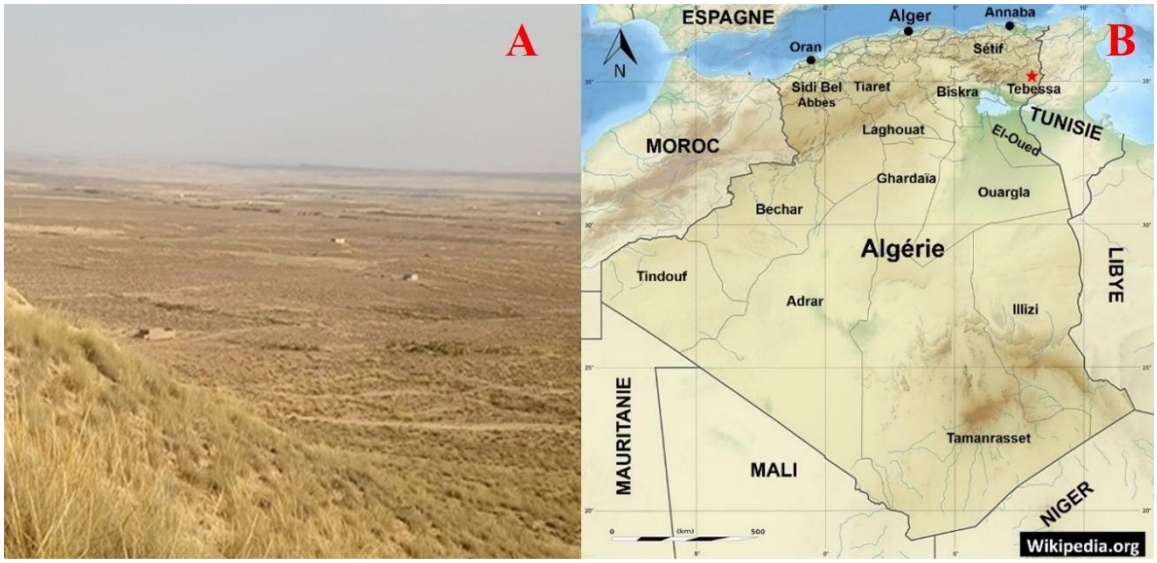

Fig. 2. The study area. A. Natural habitat of *Buthus aures* in mountain of Tebessa (Algeria). B. Map of Algeria showing the sampling area (red star).

Relationships and similarities

Buthus aures belongs to the '*Buthus occitanus*' complex of species (Lourenço & Sadine, 2016). This species shows some similarities with the other *Buthus* distributed in the north-east of Algeria and in Tunisia (Table 2).

Table 2. A morphological comparison between *Buthus aures* and the other *Buthus* species distributed in the north-east of Algeria and Tunisia.

Buthus species	Size (mm)	Number rows of granules	Pectinal teeth		Reference
			♂	♀	
B. aures	60-62.8	11-12	29-31	27-28	Current study
B. pusillus	41	11-12	27-28	--	Lourenço (2013)
B. tunetanus	70-80	10-11	29-35	24-29	Kovařík (2006)
B. paris	70-75	11-13	27-30	20-25	Lourenço *et al.* (2020)
B. dunlopi	58.3-54.2	12-12	31-33	26-28	Kovařík (2006)
B. chambiensis	62.3-67.3	11-12	30-31	27-28	Kovařík (2006)

1. *Buthus aures* shows similarities with *Buthus pusillus* in the number of rows of granules on the chela fingers, but it can be distinguished from the last species by the big size and the stronger carinae and granulations.

2. *B. tunetanus* and *B. paris* are larger species, measuring up to 70-80 mm in total length and an important number of pectinal teeth, whereas *B. aures* has a moderate size and 11-12 rows of granules on the chela fingers.

3. *B. aures* shows close similarities in the number of rows of granules on the chela fingers and pectinal teeth with Tunisian species: *B. dunlopi* and *B. chambiensis*. However, we can distinguish the difference between these species using the chela length to width ratio as mentioned by Kovařík (2006). In *B. chambiensis* the chela length to width ratio is 5.2 in male and 3.4 in female. While in *B. dunlopi* it is always higher than 4.3. But in *B. aures* it is reaching to 3.8 in male and 3.7 in female.

Fig. 3. *Buthus aures*, female, dorsal and ventral aspects.

Ecological consideration

As shown in the introduction, *B. aures* was described from Batna region in 2016. One year later, it was recorded from the mountain and the steppe zone of Khenchela northeast of Algeria (Meddour *et al.*, 2017). In 2018, this species expanded its geographical distribution to reach another neighbouring regions, Tebessa in the limit with Tunisia country (Abidi & Slimane, 2018). The current distribution of *B. aures* can be summarized in Figure (4).

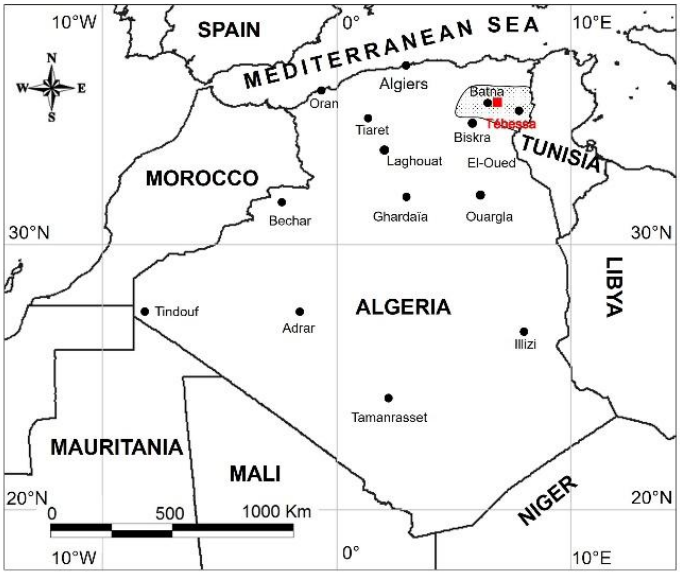

Fig. 4. Map of the present geographical distribution range of *Buthus aures* in Algeria (dashed area). Type locality (red square).

B. aures was among the most frequent species in Khenchela region (Meddour *et al.*, 2017) and in Tebessa region, this species is considered as an accessory species because it was abundant only in summer and autumn seasons (Abidi & Slimane, 2018).

Also, this species shows a close affinity to mountain and the steppe formations in high elevations as the other *Buthus* specially from the North west of Algeria (Ouici *et al.*, 2020; Lourenço *et al.*, 2020).

Acknowledgments

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New localities for *Aegaeobuthus cyprius* (Gantenbein & Kropf, 2000) in Cyprus (Scorpiones: Buthidae)

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Abstract

In this work, new locality records for the species *Aegaeobuthus cyprius* (Gantenbein & Kropf, 2000) are given in Cyprus.

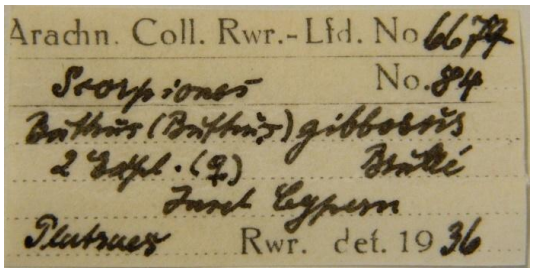
Keywords: Scorpion, *Aegaeobuthus cyprius*, distribution, Cyprus.

Introduction

Cyprus has three recorded species which are *Aegaeobuthus cyprius* (Gantenbein & Kropf, 2000), *Buthus kunti* Yağmur, Koç & Lourenço, 2011 and *Euscorpius italicus* Herbst, 1800 (Kaltsas & John, 2016). Among these species, *Aegaeobuthus cyprius* and *Buthus kunti* are endemic in Cyprus (Kovařík, 2019; Sousa *et al.*, 2017). *Euscorpius italicus* is probably introduced species to Cyprus (Yağmur, 2012) with a not established population.

Aegaeobuthus cyprius was described by Gantenbein & Kropf (2000) as *Mesobuthus cyprius* from Cyprus. This species was recorded from Cyprus for the first time as *Buthus gibbosus* Brullé, 1832 by Roewer (1943) (Figs. 1-2); subsequently, Kinzelbach (1975) corrected this record as *Mesobuthus gibbosus anatolicus* (Schenkel, 1947). *Mesobuthus cyprius* was transferred to the genus *Aegaeobuthus* very recently together with *Mesobuthus gallianoi* Ythier, 2018, *M. gibbosus* (Brullé, 1832) and *M. nigrocinctus* (Ehrenberg, 1828) and the genus *Aegaeobuthus* was established by Kovařík (2019) who confirmed the validity of *Aegaeobuthus cyprius* in the same study.

1 

2 

Figs. 1-2. 1. Two female specimens of *Aegaeobuthus cyprius* at SMF (RII/6677), reported by Roewer (1943). 2. their original label of SMF.

Roewer (1943) recorded the species *Aegaeobuthus cyprius* from Platraes (Pano Platres village) (Limassol). Gantenbein & Kropf (2000) reported it from Tepebaşı (Diorios) village (Kyrenia) and Kantara village (Famagusta). Kaltsas & John (2016) informed that *Aegaeobuthus cyprius* is distributed from sea level to 1900 m elevation in Troodos mountain abundantly. Very recently, Kovařík (2019) reported a record from Episkopi village (Paphos).

Material and Methods

We collected and examined a total of 114 (73 ♀♀, 35 ♂♂, 6 juv.) specimens that collected from 9 different localities. Specimens were collected during the night using a UV lamp, and by stone lifting and pitfall traps in the daytime. The specimens were preserved in 70% ethanol and have been deposited in AZMM, Zoology Museum of Alaşehir Vocational School, Celal Bayar University (Manisa, Turkey), ETAM, Eskişehir Technical University, Arachnology Museum (Eskişehir, Turkey), NMNU, Natural History Museum of Near East University (Nicosia, Cyprus) and SMF, Senckenberg Research Institute, Frankfurt am Main (Germany).

Results

Material examined: 1. Famagusta (Gazimağusa), Flamoudi (Mersinaltı) Village, 08.08.2018, 1♂, 35°24'36"N, 33°50'45"E, 472 m, Leg. Kunt & Gücel. **2.** Famagusta (Gazimağusa), Akanthou (Tatlısu), 2♀♀, 19.07.2014, 35°22'30"N, 33°45'41"E, 223 m, Leg. G. Constantinou. **3.** Kyrenia (Girne), Panagra (Geçitköy), 19.05.2006, 1♂, 35°19'16"N, 33°04'16"E, 163 m, Leg. Göçmen & Yıldız. **4.** Kyrenia (Girne), Lapithos (Lapta) area, 24.05.2006, 1♂, 35°19'38"N, 33°08'25"E, 711 m, Leg. Göçmen & Yıldız. **5.** Kyrenia (Girne), Vouno (Taşkent) Village, 3 km South, 04.04.2007, 12♀♀, 2♂♂, 2 juv., 35°13'58"N, 33°24'20"E, 157 m, Leg. Göçmen & Yıldız. **6.** Kyrenia (Girne), Kornokipos (Görneç, road of Yayla Tepe), 01.11.2018, 2♂♂, 35°17'21"N, 33°32'43"E, 791 m, Leg. Kunt & Gücel. **7.** Kyrenia (Girne), Kornokipos (Görneç, Yayla Tepe), 1♀, 1 juv., 12.03.2011, 35°17'28"N, 33°33'07"E, 816 m, Leg. Yağmur & Keskin. **8.** Kyrenia (Girne), Chalefka (between Alevkayası-Girnekayası), 15.08.2018, 5♀♀, 35°17'12"N, 33°31'01"E, 618 m, Leg. Kunt & Gücel. **9.** Kyrenia (Girne), Kalyvakia (Kalavaç) Village, Chalefka (Alevkayası) area, 2♀♀, 15.09.2017-13.06.2018, 35°17'06"N 33°31'41"E, 636 m, Pitfall traps, Leg. Kunt & Gücel. Same data but 2♀♀, 02.11.2018. Same data but 09.08.2018,

13♀♀, 8♂♂, 35°17'21"N 33°32'42"E, 790 m, Leg. Yağmur & Gücel. **10.** Kyrenia (Girne), Kyparissovounon (Servilitepe Hill) Road, 1♂, 01.12.2018, 35°19'36"N, 33°08'55"E, 755 m, Leg. Kunt & Gücel. **11.** Kyrenia (Girne), Larnakas tis Lapithou (Kozan), 1♀, 14.02.2016, 35°18'23"N, 33°07'48"E, 196 m, Leg. M. Hadjiconstantis. **12.** Nicosia, Kato Pyrgos, 5♀♀, 2♂♂, 13.5.2016, 35°09'58"N, 32°40'23"E, 55 m, Leg. M. Hadjiconstantis. **13.** Nicosia, Near Selladi tou Appi, 7♀♀, 4♂♂, 20.09.2020, 35°08'34"N, 32°36'51"E, 488 m, Leg. G. Constantinou. **14.** Nicosia, Marathasa Dam, 10♀♀, 3♂♂, 21.8.2015, 35°03'38"N, 32°50'12"E, 297 m, Leg. M. Hadjiconstantis. **15.** Nicosia, Kalo Chorio Picnic area, 2♀♀, 2.03.2016, 34°59'19"N, 33°09'40"E, 556 m, Leg. M. Hadjiconstantis. **16.** Nicosia, Pedoulas, 2♂♂, 6.5.2014, 34°57'31"N, 32°49'44"E, 1227 m, Pitfall traps, Leg. M. Hadjiconstantis. **17.** Nicosia, Platania Camping site, 1♀, 10.7.2014, 34°57'04"N, 32°55'37"E, 1070 m, Pitfall traps, Leg. M. Hadjiconstantis. **18.** Limassol, Prodromos Reservoir, 1♀, 10.08.2016, 34°56'39"N, 32°51'15"E, 1710 m, Leg. M. Hadjiconstantis. **19.** Paphos, Near Pano Arodes, 1 juv., 11.06.2016, 34°55'58.49"N, 32°23'7.34"E, 377 m, Leg. M. Hadjiconstantis. **20.** Paphos, Souskiou, 1 juv., 3.05.2019, 34°44'04"N, 32°35'46"E, 110 m, Leg. M. Hadjiconstantis. **21.** Paphos, Poli Chrysochus, 1♂, 15.03.2017, 35°02'00"N, 32°25'16"E, 16 m, Leg. D. Tifem. **22.** Paphos, Statos - Agios Photios, 7♀♀, 6♂♂, 24.08.2020, 34°53'16"N, 32°37'14"E, 920 m, Leg. M. Hadjiconstantis. **23.** Paphos, Tsada, 1 juv., 20.07.2019, 34°50'14"N, 32°28'47"E, 580 m, Leg. M. Hadjiconstantis. **24.** Paphos, Akamas Peninsula, 1♀, 26.03.2014, 35°02'15"N, 32°19'29"E, 360 m, Leg. M. Hadjiconstantis. **25.** Paphos, Arminou Reservoir, 2♀♀, 20.08.2018, 34°53'22"N, 32°44'50"E, 450 m, Leg. M. Hadjiconstantis. **26.** Paphos, Stavros tis Psokas, 1♀, 23.8.2017, 35°01'26.4"N, 32°37'47.8"E, 815 m, Leg. R. D. Symeou (Fig. 5).

Localities cited in the literature: 1. Limmasol, Platres (Pano Platres village), Troodos Mountain, 2♀♀, 34°53'06"N, 32°51'48"E, 1056 m, Leg. Roewer (SMF, RII/6677) (Roewer, 1943). **2.** Kyrenia (Girne), Diorios (Tepebaşı) Village, 35°18'09"N, 33°03'26"E, 213 m (Gantenbein *et al.*, 2000). **3.** Famagusta (Gazimağusa), Kantara village, 35°23'13"N, 33°53'56"E, 530 m (Gantenbein *et al.*, 2000). **4.** Kyrenia, between Kambyli and Asomatos, 35°16'50.75"N, 33°05'44.78"E, 190 m (Göçmen *et al.*, 2008). **5.** Paphos, Roudia bridge, 34°53'25"N, 32°41'06"E, 334 m (Parmakelis *et al.*, 2006). **6.** Famagusta, Kantara, 2005, (Parmakelis *et al.*, 2006). **7.** Paphos, Episkopi village, 34°47'42"N, 32°31'43"E, 150 m (Kovařík, 2019). **8.** Troodos mountain, between 0-1900 m (Kaltsas & John, 2016) (Fig. 5).

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Figs. 3-4. Alive specimens of *Aegaeobuthus cyprius* from Kalyvakia (Kalavaç) Village, Chalefka (Alevkayası) area. 3. Male. 4. Female.

Taxonomical issues: Gantenbein & Kropf (2000) determined *Aegaeobuthus cyprius* depending only on molecular data. They did not observe morphological differences, but they observed differences in its hemispermatophores. They reported that the basal lobes hemispermatophores of *Aegaeobuthus cyprius* are with slender and acutely pointed teeth. Recently, Kovařík (2019) published the shape of *Aegaeobuthus cyprius* telson. It has bulbous and not elongated telson according to the illustration of Kovařík (2019). According to our observations, *Aegaeobuthus cyprius* has colouration relatively lighter than that of *Aegaeobuthus gibbosus* (Figs. 3-4).

Fig. 5. Distribution map of *Aegaeobuthus cyprius* in Cyprus, exported from Google Earth Pro. Circles are new localities and triangles are literature records. Each shape is numbered as mentioned in the text. Records referring to the same location are merged.

Comments: According to published records of *Aegaeobuthus cyprius* herein, it is distributed in Cyprus in mountainous and arid hard soil lowlands. Although Yağmur *et al.* (2011) described *Buthus kunti* after *A. cyprius* and said that Cyprus is the only territory where *Aegaeobuthus* (as *Mesobuthus*) and *Buthus* genera exist together and added that *B. kunti* is present in sandy lowlands in Cyprus and they have not been detected at the same locality in Cyprus until now. After all, the information about *B. kunti* and its distribution is limited. Probably the two species occupy different ecological niches and *B. kunti* is present only on habitats with sandy soil.

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A hornet is fed upon by a spider, *Argiope amoena* (Araneae: Araneidae)

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Abstract

I report herein an observational case that *Argiope amoena*, a common large orb-weaving spider representative in Japan, preyed on a yellow-vented hornet *Vespa analis insularis* with wrapping. It was previously reported that about half of the diets foraged by *A. amoena* are composed of Hymenoptera mainly honeybees and ants (Formicidae gen. sp.). However, to my knowledge, the cases that a hornet of *Vespa* sp., the largest of the eusocial wasps and known as a predator of insects and spiders, is fed upon by *A. amoena*, are rarely documented in scientific literature; by contrast, some cases, vespine hornets attack *Argiope* spiders and steal the prey items from the web of argiopids, have been reported. The present study shows that *A. amoena* is not only a prey fed upon by the vespid but also one of the natural enemies of the yellow jacket such as *V. analis*.

Keywords: Araneae, Diet, Hymenoptera, Prey-Predation Relationships, *Vespa analis insularis*, Vespidae, Web-building Spider.

Introduction

A spider of the genus *Argiope* is rather large orb-weaver. *Argiope* contains 86 species and 3 subspecies (World Spider Catalog, 2020) and there are seven species belonging to the genus in Japan (Ono, 2009). The spider *Argiope amoena* L. Koch, 1878, known as a common argiopid spider, inhabits the main island and southwestern portion of Japan (e.g. Kishida, 1936; Murakami, 1983; Ono & Ogata, 2018). Ono (2014) stated that it is no exaggeration to say that *A. amoena* is a representative spider of Japan. Recently, however, in metropolitan areas such as Tokyo, *A. amoena* has been categorized as Near Threatened (NT) (Ono *et al.*, 2019). A reason why the population of *A. amoena* is

decreasing is speculated that so-called bush environment suitable for large insects, supposed to be potential prey for *A. amoena*, has been destroyed (Ono, 2014).

Hornets (Insecta, Hymenoptera, Vespidae) are large, predatory, eusocial wasps and centred in Asia and Europe (Smith-Pardo *et al.*, 2020). Seven species from the Vespidae are described in Japan (Matsuura, 1988). Species of vespine wasps, the hornet such as *Vespa crabro* Linnaeus, 1758, and *Vespula* species sometimes capture spiders as food for their brood (Helsdingen, 2011). Matsuura & Yamane (1990) reviewed the cases that *Vespula vulgaris* (Linnaeus, 1758) (Broekhuizen & Hordijk, 1968), *Vespula flaviceps* (Smith, 1870) (Iwata, 1971), *Vespa simillima* Smith, 1868 captured spiders and *Vespa mandarinia* Smith, 1852 fed upon *A. amoena* and *Argiope bruennichi* (Scopoli, 1772) (Matsuura, 1984). *Argiope bruennichi* has also observed to be attacked by *V. crabro* (Bruggisser *et al.*, 2012). Additionally, *V. crabro* acts as a regular kleptoparasite as well as predator on *A. bruennichi* (Helsdingen, 2011); a stealing of the captured prey from *Argiope aurantia* Lucas, 1833 was also observed (Davis, 2011). Therefore, spiders, well known as predators of insects and spiders, are also prey for hornets. Conversely, of course, spiders are predators of hornets, aren't they?

It is accounted that web-constructing spiders can be both victims and predators of *Vespula* (Matsuura & Yamane, 1990). However, on the other hand, there are few descriptions of such observed cases that spiders hunt hornets in literature (Matsuura & Yamane, 1990; Richter, 2000; Smith-Pardo *et al.*, 2020). Foelix (2011) noted that most spiders generally avoid certain insects, such as stink bugs (Pentatomidae), ants (Formicidae), and wasps, etc. This would explain the reason that the lack of the reported cases of predation, the hornet was fed upon by spiders.

Because orb-web spiders could both attack and be attacked by hornets, *A. amoena* must hunt the hornets of Vespidae depending on the time. Nevertheless, to the best of my knowledge, despite the fact that web spiders are common truly polyphagous predators (Murakami, 1983), it seems that feeding upon the vespine hornets by spiders has been little reported yet in scientific research papers concerning *A. amoena*. Only very rarely once, the cases had described that an argiopid spider captured the species of hornets, vespine wasps, i.e., *A. bruennichi* fed upon *Vespa germanica* (Fabricius, 1793) and *Vespa maculata* (Linnaeus, 1763) (Bilsing, 1920) [Now in other genera: *Vespula* and *Dolichovespula*].

A yellow-vented hornet *Vespa analis insularis* Dalla Torre, 1894, the Japanese subspecies, is distributed in Japan from North area to Tanegashima Island and Yakushima Island (located south of Kyushu Island) (Matsuura & Yamane, 1990). In the present study, an observational case of *A. amoena* preying on *V. analis* in the web with wrapping is described. The body size of *V. analis* was measured and the size ratio of *A. amoena* and *V. analis* was estimated from a photograph is also described.

Material and Methods

The observation of the predation was carried out in the Bunkyo Campus at Nagasaki University. The photographs were taken using a Canon digital camera IXY 630 (Tokyo, Japan).

Results and Discussion

I observed that an adult female *A. amoena* preyed on a *V. analis insularis* in the centre of the web with wrapping, on a hedgerow of azalea (*Rhododendron* sp.) plant at 15:23 pm on July 10, 2020 (Fig. 1). The weather was windy and often rainy. The hunting

was already complete at the time of the observation. I collected the dead individual of the hornet from the web and body size was measured by a ruler; the length of the body was 17.8 mm (Fig. 2). From a photograph (two individuals were little overlapped each other), the length of the argiopid was estimated to be 1.4 times the length of the hornet.

Fig. 1. *Argiope amoena* preyed on *Vespa analis insularis* with wrapping.

Fig. 2. An individual of *Vespa analis insularis*. (Scale = 5 mm).

Murakami (1983) reported that 387 individuals of the prey items foraged by *A. amoena* were composed of Hymenoptera (49.7%) including honeybee *Apis cerana* Fabricius, 1793 and Formicidae gen. sp. mainly, followed by Coleoptera (28.1%) and Hemiptera (19.9%). In the diet of *A. amoena*, small Diptera were very rare (only 1.7%), unlike such as *A. bruennichi*, also a common orb-web spider (Nyffeler & Benz, 1978; Pasquet, 1984). By analyzing these data of the diet, it was confirmed that *A. amoena* is a predator of euryphagy (Pekár *et al.*, 2012). But to my knowledge, there are only very few cases observed that a hornet, vespine wasp like *V. analis*, is fed upon by a web-constructing spider *A. amoena* and such cases have rarely documented.

Foelix (2011) noted that when bees or wasps get caught in a spider web, they sometimes manage to push their stinger into the soft joint membranes of the spider's legs. Orb weavers such as *Argiope* species behave like that; first, they wrap the prey items and then bite. Consequently, the offensive wrapping of prey such as a vespine hornet yields advantages for the spider that there is less danger of being harmed by strong prey like a stinging hornet. Thus, it is conceivable that this usual tactic for argiopids to capture prey must be used in the present case.

Vespa analis is relatively small for vespid wasps, actually, in the present case, the length of the hornet is about 72% of that of spider *A. amoena*. Hence the difference of the body size would be very helpful for *A. amoena* to defeat a predatory hornet. Then, questions are raised that why didn't the hornet avoid a relatively large argiopid like *A. amoena*? Did the vespid need to dare attack a larger spider than herself? It was often rainy and comparatively windy at the day. If the vespid had difficulty in controlling the precise flight prevented by strong wind, this should be an additional disadvantage not for a web spider but for a hornet. I think that the body sizes, the orb-weaver was slight larger than the vespid, and circumstances like weather condition such as strong wind could influence the prey-predator relationships between the web spiders and the hornets.

Vespids are serious pests for Japanese beekeepers, because the hornets cause damage to beehives (Matsuura & Sakagami, 1973). Furthermore, there are ca. 30 deaths per year from stings by social wasps and bees in Japan (Matsuura, 2000). Ori (1975) and Higa *et al.* (1994) reported some spider bite incidences; on the contrary, the risk of the spiders is very little compared with that by wasps and hornets. There would be no cases that *A. amoena* caused harmful damage to mankind. It would be of importance for us to live an abundant life with web spiders, one of the natural enemies of the hornet, and less risks derived from stings of vespid wasps. Though, there is almost no information about the hornet as prey to orb-weavers until now.

In summary, the present observational case, *A. amoena* preyed a predatory hornet of vespine wasps, reinforces and proves again the statement that web-constructing spiders can be both prey and predators of the hornet species. Concerning prey-predatory relationships like *Argiope* spiders and Vespidae wasps could be a small step to provide useful point of view that protection of the environment suitable for the web-building spiders, especially *A. amoena*, Near Threatened as in Tokyo. Further researches are necessary to clarify a role played by the web-building spider as a natural enemy for the vespine wasps from the viewpoint like biocontrol.

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The diversity of spiders from the vicinity of Dharoi Reservoir, North Gujarat, India

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Abstract

The present study of spiders was conducted in 2016 to 2018 around five sites of Dharoi Reservoir, North Gujarat. The study was planned to determine the spider diversity at various habitats like Natural forest, Grassland, Hilly area, and agriculture area. A total of 981 samples were collected using various methods like line transects, visual searching, vegetation beating, sweep netting, beating sheets, aerial hand collection, ground hand collection, and hand-picking, etc. Out of a total of 142 species of spiders belonging to 86 genera and 25 families were recorded. Most numerical dominant families were Araneidae and Salticidae followed by Thomisidae, Tetragnathidae, Sparassidae, and other families that contribute less than 5% in total recorded spiders. This region has detected more than 43% of Indian spiders families. The result of this study pointed out the high conservation importance of natural forest for the existence of spiders' fauna.

Keywords: Spiders, diversity, Dharoi, Gujarat. India.

Introduction

Spiders are occurring in all terrestrial ecosystems as predator organisms; they exert an important regulatory function. Order Araneae is one in all the larger orders in phylum Arthropoda of the kingdom Animalia. There are concerning 48643 species of 4173 genera belonging to 128 families of spiders within the world (World Spider Catalog, 2020) and concerning 1686 species belonging to 438 genera of 60 families from the Indian subcontinent (Keswani *et al.*, 2012). The spider diversity of Gujarat consists of 415 species under 169 genera and 40 families (Yadav *et al.*, 2017). In Gujarat, ninety species belonging to 46 genera and 18 families were recorded from Mahesana (Patel &

Patel, 2015) and 157 species were identified belonging to 27 families and 88 genera to indicate an extremely diverse and wealthy spider fauna in Satlasana Taluka (Parmar, 2018).

Material and Methods

Study Area

The Dharoi reservoir is the most significant reservoir in North Gujarat at the point of irrigation. The study area is located in three Districts of North Gujarat named Mahesana, Banaskantha, and Sabarkantha. A total of 349.39 hectare areas fall under this reservoir; 28 villages are fully and 19 villages are partially submerged in this reservoir. The climate of the Dharoi reservoir is considered by a hot summer and general aridness for the most part of the year. The ranges of day temperatures are around 38°C in summer and 20°C in winter. The average yearly rainfall is 618.7 mm.

Methodology

The study was applied from 2016 to 2018 using line transects, visual searching, vegetation beating, sweep netting, beating sheets, aerial hand collection, ground hand collection, and hand-picking in 5 study sites (Table 1). The line transects were of 1.5 kms length and 20 m width, with sampling, restricted to a maximum height of 1.6 m. The sampling methods of the spiders included: Ground hand collections were done searching for leaf litter or fallen dry wood; Sweep netting was done through standard sweeps for the foliage home spiders covering the herbs, and shrubs; Aerial hand collection and beating sheets were wooden standard stick and an umbrella placed beneath the branches of tiny trees to catch the spiders. Web pattern, habitat type, section, and different notes of importance were recorded with every encounter. The spiders were placed separately in vials with 70% ethyl alcohol. All such specimens were kept within the specimen tubes properly labelled with the date, detailed and elaborate notes of importance. For a detailed examination of all specimens a stereo zoom microscope (Olympus SZ51) was used. Standard references, monographs and taxonomic keys (Pocock, 1900; Tikader, 1977, 1980, 1982a, 1982b, 1987; Tikader & Malhotra, 1980; Sebastian & Peter, 2009) are used for identification of spiders with World Spider Catalog (2020).

Table 1. Sites description of study area.

No.	Site name	Geographical location	Description
1	Dharoi Village	24°00’26”N, 72°50’32”E	Mixed thorny type Natural jungle and around agriculture farming
2	Umedpura Village	24°02’59”N, 72°51’54”E	Submerge land, agriculture farming, and Tropical thorn scrub type vegetation
3	Bhavangadh Village	24°03’19”N, 72°50’23”E	Tropical thorn scrub type vegetation
4	Nakod Village	23°59’56”N, 72°55’55”E	Submerge land and agriculture farming
5	Mahor Village	23°58’15”N, 72°51’59”E	Tropical thorn scrub type vegetation

Results

A total of 142 species (Table 2) were recorded and identified from Dharoi Reservoir from 2016 to 2018. The family Araneidae was numerical dominant which had the highest number of species (32); followed by Salticidae (25), Thomisidae (10),

Tetragnathidae (9), Theridiidae (8), Sparassidae (8), and Oxyopidae (7). Most of the other families had less than 5 species. Total of nine guilds (Table 3) were recorded during the study: the orb-weaving spiders with the highest number of total species with 45 species (31.69.% of all species), followed by stalker spiders with 32 species (22.53%), ground spiders with 27 species (19.09%), irregular web builder with 12 species (8.45%), ambusher spiders with 12 species (8.45%), foliage hunter/ runner spiders with 6 species (4.22%), and other guilds consist of less than 5% of spiders.

Table 2. Systematic list of recorded spiders in the study area.

No.	Family	Name of species
1	ARANEIDAE	*Araneus bilunifer*
2		*Araneus ellipticus*
3		*Araneus mitificus*
4		*Argiope anasuja*
5		*Chorizopes* sp.
6		*Cyclosa bifida*
7		*Cyclosa confraga*
8		*Cyclosa* sp.
9		*Cyrtophora cicatrosa*
10		*Cyrtophora citricola*
11		*Eriophora* sp.
12		*Eriovixia excelsa*
13		*Eriovixia laglaizei*
14		*Gasteracantha geminata*
15		*Gea spinipes*
16		*Larinia chloris*
17		*Larinia phthisica*
18		*Larinia* sp.
19		*Neoscona mukerjei*
20		*Neoscona nautica*
21		*Neoscona odites*
22		*Neoscona subfusca*
23		*Neoscona theisi*
24		*Neoscona vigilans*
25		*Neoscona* sp.1
26		*Neoscona* sp.2
27		*Nephila pilipes*
28		*Parawixia dehaani*
29		*Poltys bhabanii*
30		*Poltys* sp.
31		*Singa* sp.
32		*Thelacantha brevispina*
33	CHEIRACANTHIIDAE	*Cheiracanthium* sp.1
34		*Cheiracanthium* sp.2
35	CLUBIONIDAE	*Clubiona drassodes*
36		*Clubiona* sp.
37	CORINNIDAE	*Castianeira tinae*

38		*Castianeira* sp.
39	CTENIDAE	*Ctenus* sp.
40	ERESIDAE	*Stegodyphus pacificus*
41		*Stegodyphus sarasinorum*
42	FILISTATIDAE	*Pritha napadensis*
43		*Sahastata ashapuriae*
44	GNAPHOSIDAE	*Drassodes* sp.
45		*Gnaphosa stoliczkai*
46		*Poecilochroa* sp.
47		*Zelotes* sp.
48	HERSILIIDAE	*Hersilia savignyi*
49		*Hersilia* sp.
50	LYCOSIDAE	*Arctosa indica*
51		*Hippasa agelenoides*
52		*Lycosa tista*
53		*Lycosa* sp.
54		*Pardosa birmanica*
55		*Pardosa* sp.
56	OECOBIIDAE	*Oecobius putus*
57		*Uroctea thaleri*
58		*Uroctea* sp.
59	OXYOPIDAE	*Hamataliwa* sp.
60		*Oxyopes javanus*
61		*Oxyopes minutus*
62		*Oxyopes ryvesi*
63		*Oxyopes* sp.
64		*Peucetia elegans*
65		*Peucetia* sp.
66	PHILODROMIDAE	*Philodromus* sp.
67		*Tibellus* sp.
68	PHOLCIDAE	*Crossopriza lyoni*
69		*Pholcus phalangioides*
70		*Pholcus* sp.
71		*Physocyclus globosus*
72	PISAURIDAE	*Perenethis* sp.
73		*Pisaura* sp.
74	SALTICIDAE	*Carrhotus sannio*
75		*Carrhotus viduus*
76		*Epeus indicus*
77		*Epocilla aurantiaca*
78		*Hasarius adansoni*
79		*Hyllus semicupreus*
80		*Menemerus bivittatus*
81		*Menemerus brachygnathus*
82		*Menemerus fulvus*
83		*Myrmaplata plataleoides*
84		*Myrmarachne* sp.
85		*Phidippus* sp.

86		*Phintella vittata*
87		*Phintella* sp.
88		*Phlegra dhakuriensis*
89		*Plexippus paykulli*
90		*Plexippus petersi*
91		*Rhene* sp.
92		*Siler semiglaucus*
93		*Stenaelurillus lesserti*
94		*Stenaelurillus* sp.1
95		*Stenaelurillus* sp.2
96		*Telamonia dimidiata*
97		*Thiania* sp.
98		*Thyene imperialis*
99	SCYTODIDAE	*Scytodes thoracica*
100		*Scytodes* sp.
101	SELENOPIDAE	*Selenops* sp.
102	SICARIIDAE	*Loxosceles rufescens*
103	SPARASSIDAE	*Heteropoda bhaikakai*
104		*Heteropoda venatoria*
105		*Heteropoda* sp.
106		*Olios bhavnagarensis*
107		*Olios iranii*
108		*Olios milleti*
109		*Olios wroughtoni*
110		*Olios* sp.
111	TETRAGNATHIDAE	*Guizygiella indica*
112		*Guizygiella melanocrania*
113		*Guizygiella shivui*
114		*Leucauge decorata*
115		*Tetragnatha keyserlingi*
116		*Tetragnatha mandibulata*
117		*Tetragnatha viridorufa*
118		*Tetragnatha* sp.
119		*Tylorida ventralis*
120	THERIDIIDAE	*Achaearanea triangularis*
121		*Achaearanea* sp.
122		*Argyrodes argentatus*
123		*Argyrodes flavescens*
124		*Chrysso angula*
125		*Chrysso* sp.
126		*Steatoda* sp.
127		*Theridion* sp.
128	THOMISIDAE	*Diaea* sp.
129		*Indoxysticus minutus*
130		*Misumena* sp.
131		*Oxytate* sp.
132		*Runcinia* sp.
133		*Synema decoratum*

134		*Thomisus lobosus*
135		*Thomisus projectus*
136		*Thomisus* sp.
137		*Xysticus kali*
138	ULOBORIDAE	*Uloborus danolius*
139		*Uloborus krishnae*
140		*Uloborus* sp.
141		*Zosis* sp.
142	ZODARIIDAE	*Mallinella* sp.

Table 3. Generic distribution and guilds of spiders.

No.	Family	Genera	Species	Family distribution (%)	Guild
1	Araneidae	16	32	22.69	Orb web weaver
2	Cheiracanthiidae	1	2	1.40	Foliage runner
3	Clubionidae	1	2	1.40	Foliage hunter
4	Corinnidae	1	2	1.40	Ground runner
5	Ctenidae	1	1	0.70	Ground runner
6	Eresidae	1	2	1.40	Snare/sheet web builder
7	Filistatidae	2	2	1.40	Funnel web
8	Gnaphosidae	4	4	2.81	Ground runner
9	Hersiliidae	1	2	1.40	Foliage hunter
10	Lycosidae	4	6	4.22	Funnel web/ground runner
11	Oecobiidae	2	3	2.11	Disc web builder
12	Oxyopidae	3	7	4.92	Stalker
13	Philodromidae	2	2	1.40	Ambusher
14	Pholcidae	3	4	2.81	Scattered line weaver
15	Pisauridae	2	2	1.40	Ground runner/nursery web builder
16	Salticidae	17	25	17.60	Stalker
17	Scytodidae	1	2	1.40	Ground runner
18	Selenopidae	1	1	0.70	Ground runner
19	Sicariidae	1	1	0.70	space web-weaver
20	Sparassidae	2	8	5.63	Ground runner
21	Tetragnathidae	4	9	6.33	Orb web weaver
22	Theridiidae	5	8	5.63	Scattered line weaver
23	Thomisidae	8	10	7.04	Ambusher
24	Uloboridae	2	4	2.81	Orb web weaver
25	Zodariidae	1	1	0.70	Ground runner
	Total	**86**	**142**	**100**	

Discussion and Conclusion

The study leads to the conclusion that the spider diversity of the Dharoi Reservoir is very rich in quality and quantity. The natural and undisturbed forest is consisting of high plant diversity that forms a complex structure that supports a number of animals including spiders (Uetz, 1991). However, if the natural forest becomes fragmented or land use pattern changes, certain factors act as a barrier within the dispersion and

abundance of species (Bonte *et al.*, 2004). Since the study area is a human-dominated landscape, they are facing threats like habitat loss, mining, pollution, and changes in land-use patterns. But necessary steps need to be taken up to conserve the spider fauna. This can be done by educating the students, school nature club, scientists, local forest department and farmers to preserve the natural equilibrium in the various habitats.

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Spiders of rocky desert in Kailana, Rajasthan, India

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Abstract

The Thar Desert constitutes a unique ecosystem in Indian subcontinent characterized by low rainfall, dryness, and extreme temperature. Ecologically, natural habitats in the Thar Desert can be classified as sandy, gravelly, and rocky. These arid rocky regions of the Thar Desert are totally unexplored in arachnological point of view. This study is a pioneering attempt to document the diversity of spider fauna of Kailana, Rajasthan which is a part of rocky desert. Spiders were collected for two years (December 2016-December 2018) using several methods: hand picking, aspiration, beating net, and litter sampling techniques. A total of 59 species of spiders belonging to 12 families under 30 genera were recorded during the study. Twelve species are new records from Rajasthan. The most diverse family collected was Araneidae followed by Salticidae. Guild structure analysis of collected spiders revealed six feeding guilds viz., stalkers, sheet-web builders, orb weavers, ground runners, foliage runners, and ambushers.

Keywords: Araneae, Thar Desert, Jodhpur, Guild structure, Rajasthan, India.

Introduction

Spiders are major terrestrial entomophagous predators in nature (Moulder & Reichle, 1972). They indirectly increase plant biomass and primary productivity by reducing herbivorous arthropod populations through predation (Lawrence & Wise, 2000). Studies have also shown that spiders play vital role in indirectly enhancing ecological processes like decomposition (Lawrence & Wise, 2004). Spiders can be considered as

ecological indicators, as they have been studied for monitoring pollution and ecosystem health (Clausen, 1986). Size of spiders and their fecundity are found to increase in areas with more anthropogenic disturbance (Lowe *et al.*, 2014).

The perusal of literature reveals that despite the ecological importance of spiders, they have been only sparsely studied in the Thar Desert landscape of India. Tikader (1966) reported 13 species of spiders from desert areas of Rajasthan. A preliminary study on spider fauna of Desert National Park reported 28 species of spiders belonging to 13 families and 21 genera (Sivaperuman & Rathore, 2004). Present work is the pioneering attempt to study the spiders of rocky arid region of the Thar Desert. Ecologically, natural habitats in the Thar Desert can be classified as sandy, gravelly, and rocky. These arid rocky regions of the Thar Desert are totally unexplored in arachnological point of view. The study area is Kailana which consists of hilly rocky to gravelly scrub area of the Thar Desert. Most of the studies on other faunas in this region have been done from Machia Safari Park an *insitu* conservation area and lake Kailana near by the present study site. A total of 146 species of birds belonging to 43 different families were reported from this area (Ram *et al*., 2011) and 18 species of Lepidoptera belonging to 15 genera and 9 families were also observed in this region (Rajpurohit *et al*., 2017). Thakur (1985) listed 18 species of Odonata around lake Kailana. Soota *et al*. (1983) studied sponges of Lake Kailana and their ecology. Rathore & Bohra (1987) studied the molluscan fauna of Lake Kailana. The present study was undertaken with an objective to prepare the checklist of spiders of arid rocky region of the Thar Desert at Kailana for the first time.

Material and Methods

Study area

Kailana is located 8 km north-west to Jodhpur city, Rajasthan, India. The area lies at 26.289ºN and 72.974ºE. It is located near an artificial lake called Kailana and Machia forest block. Igneous rock formations can be seen in areas in and around Kailana. Volcanic rock found here is chiefly rhyolite. This region is characterized by rocky to gravelly terrain with ridges. Climatically this region falls under semi-arid zone. Annual rainfall is 363 mm restricted mainly to months of July to August. Average annual maximum and minimum temperature ranges from 49ºC to 20ºC. Arid desert vegetation predominates here. Common plants noted in this habitat are *Barleria* sp., *Capparis decidua*, *Cleome viscosa*, *Euphorbia caducifolia*, *Grewia tenax*, *Indigofera cordifolia*, *Prosopis juliflora*, *Tephrosia purpurea* etc.

Methods

The study was conducted from December 2016 to December 2018. The spiders were collected by hand picking, aspiration, beating net, and litter sampling techniques. Rocks were upturned and searched for spiders. The collected specimens were preserved in vials containing 70% ethyl alcohol. All the vials were labelled with the place, date of collection, and other relevant information. All the preserved specimens were taken to the laboratory and were identified using Leica-M205C Stereozoom microscope. Adult specimens were identified by dissecting out the genital structures, *i.e.* epigynes and palps. Attempts were made to identify juveniles by examining morphological characters. Adults were identified up to species level and juveniles up to genus level using standard literature (Barrion & Litsinger, 1995; Jocqué & Dippenaar-Schoeman, 2006; Prószyński, 2017; Tikader, 1982a, 1982b; Tikader & Malhotra, 1980).

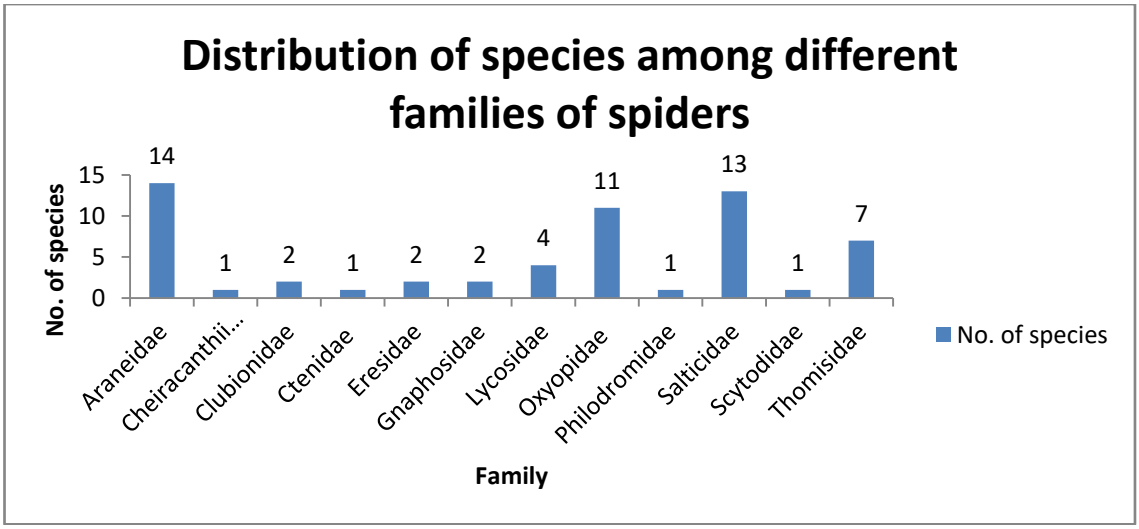

Fig. 1. Graph showing the distribution of species among different families of spiders.

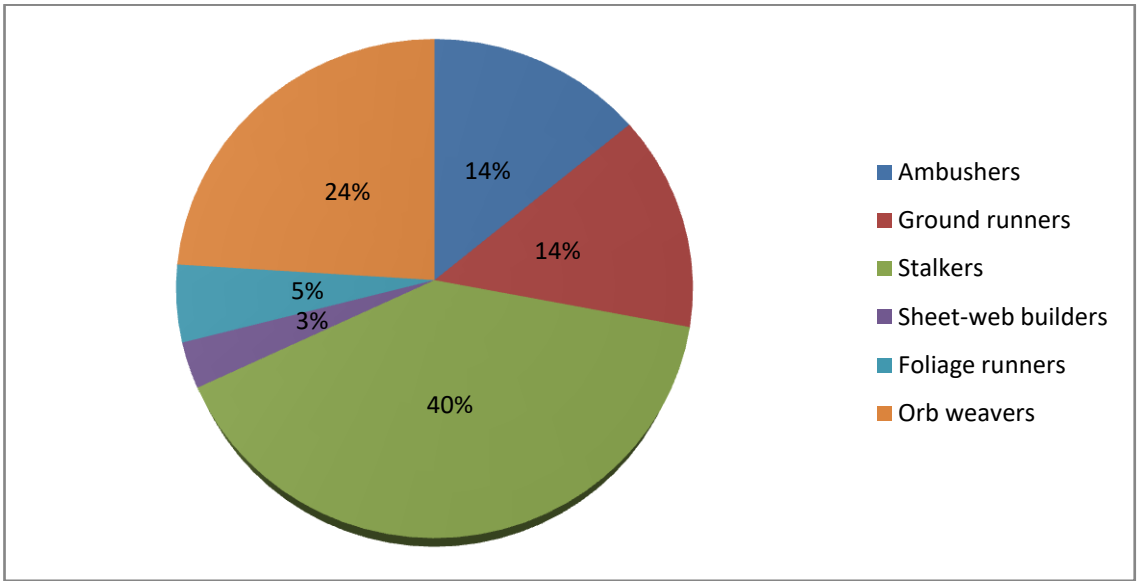

Fig. 2. Pie chart showing the guild structure of spiders.

Results and Discussion

A total of 59 species of spiders belonging to 12 families under 30 genera were recorded during the study (Table 1). Twelve species viz., *Araneus panchganiensis*, *Cyrtophora moluccensis*, *Draposa atropalpis*, *Hamataliwa subhadrae*, *Neoscona biswasi*, *Neoscona odites*, *Oxyopes chittrae*, *Oxyopes gujaratensis*, *Ozyptila brevipes*, *Peucetia latikae*, *Peucetia yogeshi*, and *Rudakius ludhianaensis* are new records from Rajasthan. Araneidae is the most species rich family with 14 species of 5 genera followed by Salticidae with 13 species belonging to 8 genera (Fig. 1). Guild structure analysis (Uetz *et al*., 1999) yielded six types of feeding guilds viz., Ambushers, Ground runners, Stalkers, Sheet-web builders, Foliage runners, and Orb weavers. Stalkers were found to be the dominant guild constituting 40% of the total samples collected. Stalkers were followed by Orb weavers (24%), Ambushers (14%), Ground runners (14%), Foliage runners (5%), and Sheet-web builders (3%) (Fig. 2).

Table 1. Checklist of spiders of Kailana.

No.	Family / Species	Guild Structure
I	**Araneidae** Clerck, 1757	
1	*Araneus panchganiensis* Tikader & Bal, 1981	Orb weavers
2	*Araneus* sp.	Orb weavers
3	*Cyrtophora cicatrosa* (Stoliczka, 1869)	Orb weavers
4	*Cyrtophora citricola* (Forsskål, 1775)	Orb weavers
5	*Cyrtophora moluccensis* (Doleschall, 1857)	Orb weavers
6	*Herennia multipuncta* (Doleschall, 1859)	Orb weavers
7	*Larinia chloris* (Savigny, 1825)	Orb weavers
8	*Neoscona biswasi* Bhandari & Gajbe, 2001	Orb weavers
9	*Neoscona mukerjei* Tikader, 1980	Orb weavers
10	*Neoscona nautica* (L. Koch, 1875)	Orb weavers
11	*Neoscona odites* (Simon, 1906)	Orb weavers
12	*Neoscona pavida* (Simon, 1906)	Orb weavers
13	*Neoscona theisi* (Walckenaer, 1841)	Orb weavers
14	*Neoscona* sp.	Orb weavers
II	**Cheiracanthiidae** Wagner, 1887	
15	*Cheiracanthium melanostomum* (Thorell, 1895)	Foliage runners
III	**Clubionidae** Wagner, 1887	
16	*Clubiona filicata* O. Pickard-Cambridge, 1874	Foliage runners
17	*Clubiona* sp.	Foliage runners
IV	**Ctenidae** Keyserling, 1877	
18	*Ctenus* sp.	Ground runners
V	**Eresidae** C.L. Koch, 1845	
19	*Stegodyphus pacificus* Pocock, 1900	Sheet-web builders
20	*Stegodyphus sarasinorum* Karsch, 1892	Sheet-web builders
VI	**Gnaphosidae** Pocock, 1898	
21	*Gnaphosa kailana* Tikader, 1966	Ground runners
22	*Gnaphosa* sp.	Ground runners
VII	**Lycosidae** Sundevall, 1833	
23	*Draposa atropalpis* (Gravely, 1924)	Ground runners
24	*Lycosa tista* Tikader, 1970	Ground runners
25	*Pardosa birmanica* Simon, 1884	Ground runners
26	*Pardosa pusiola* (Thorell, 1891)	Ground runners
VIII	**Oxyopidae** Thorell, 1870	
27	*Hamataliwa subhadrae* (Tikader, 1970)	Stalkers
28	*Oxyopes birmanicus* Thorell, 1887	Stalkers
29	*Oxyopes chittrae* Tikader, 1965	Stalkers
30	*Oxyopes gujaratensis* Gajbe, 1999	Stalkers
31	*Oxyopes javanus* Thorell, 1887	Stalkers
32	*Oxyopes pankaji* Gajbe & Gajbe, 2000	Stalkers
33	*Oxyopes shweta* Tikader, 1970	Stalkers
34	*Peucetia latikae* Tikader, 1970	Stalkers
35	*Peucetia viridana* (Stoliczka, 1869)	Stalkers
36	*Peucetia yogeshi* Gajbe, 1999	Stalkers
37	*Peucetia* sp.	Stalkers

IX	**Philodromidae** Thorell, 1870	
38	*Philodromus* sp.	Ambushers
X	**Salticidae** Blackwall, 1841	
39	*Aelurillus improvisus* Azarkina, 2002	Stalkers
40	*Afraflacilla* sp.	Stalkers
41	*Langona* sp.1	Stalkers
42	*Langona* sp.2	Stalkers
43	*Menemerus bivittatus* (Dufour, 1831)	Stalkers
44	*Menemerus brachygnathus* (Thorell, 1887)	Stalkers
45	*Mogrus rajasthanensis* Caleb, Chatterjee, Tyagi, Kundu & Kumar, 2017	Stalkers
46	*Mogrus* sp.1	Stalkers
47	*Mogrus* sp.2	Stalkers
48	*Pellenes* sp.	Stalkers
49	*Rudakius ludhianaensis* (Tikader, 1974)	Stalkers
50	*Thyene imperialis* (Rossi, 1846)	Stalkers
51	*Thyene* sp.	Stalkers
XI	**Scytodidae** Blackwall, 1864	
52	*Scytodes* sp.	Ground runners
XII	**Thomisidae** Sundevall, 1833	
53	*Bomis* sp.	Ambushers
54	*Ozyptila brevipes* (Hahn, 1826)	Ambushers
55	*Ozyptila reenae* Basu, 1964	Ambushers
56	*Thomisus lobosus* Tikader, 1965	Ambushers
57	*Thomisus* sp.	Ambushers
58	*Tmarus kotigeharus* Tikader, 1963	Ambushers
59	*Tmarus* sp.	Ambushers

This study is the pioneering approach to explore spiders of arid rocky habitat of the desert. A better understanding of biodiversity of a region can contribute to the planning of conservation efforts in that area. This study reports 59 species of spiders which is indeed a good number in desert scenario. Further research on biodiversity of Thar Desert is urgently required as it is facing several threats like climate change, impact of Indira Gandhi Canal project, mining activities population pressure etc. (Sharma *et al*., 2013).

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A new species of genus *Idiops* Perty, 1833 from West Bengal, India (Araneae: Mygalomorphae: Idiopidae)

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Abstract

A new species of the trapdoor spider genus *Idiops* Perty, *Idiops medini* Pratihar & Das sp. nov. is described here from West Bengal, India based on a female specimen. Natural history information and type locality map of the new species are provided.

Keywords: Araneae, Idiopidae, Trapdoor spider, West Bengal, natural history, India.

Introduction

The mygalomorph spiders have a world-wide distribution that includes among its ranks large and charismatic taxa such as tarantulas, trapdoor spiders, and highly venomous funnel web spiders (Opatova *et al.*, 2020). At present, total 3111 species of mygalomorph spiders are described in the world under 358 genera in 30 families (World Spider Catalog, 2020). However, in India these spiders remain poorly documented with reporting of only 112 species under 32 genera in 9 families (World Spider Catalog, 2020). Among Indian mygalomorphs, the trapdoor spider family Idiopidae is the most widespread and species-rich family after Theraphosidae and represented by three genera and 25 species, of which 16 species belong to the genus *Idiops* Perty, 1833 (World Spider Catalog, 2020). In this paper, we describe a new species, *Idiops medini* Pratihar & Das sp. nov. based on a female specimen from West Bengal.

Fig. 1. *Idiops medini* Pratihar & Das sp. nov., ♀ holotype, alive.

Material and Methods

The type specimen is deposited at Indraprastha University Museum (IPUM), New Delhi, India. All measurements are in millimetres and were taken with Olympus CellSens standard software. Leg measurements were taken dorsally for the left side. Eye measurements were done with calibrated ocular micrometer. Spermathecae were dissected and cleared in concentrated lactic acid. Total length excludes chelicerae. The microphotographic images were taken by Olympus LC30 digital camera and all illustrations were prepared with the help of a camera lucida attached to an Olympus SZX10 stereomicroscope. The taxonomic description style follows Das *et al.* (2019).

Abbreviations used: ALE = anterior lateral eye, AME = anterior median eye, MOQ = median ocular quadrate, PLE = posterior lateral eye, PLS = posterior lateral spinnerets, PME = posterior median eye, PMS = posterior median spinnerets. Abbreviations used for hair and spines count: d = dorsal, fe = femur, mt = metatarsus, p = prolateral, pa = patella, r = retrolateral, ta = tarsus, ti = tibia, v = ventral.

Systematic account

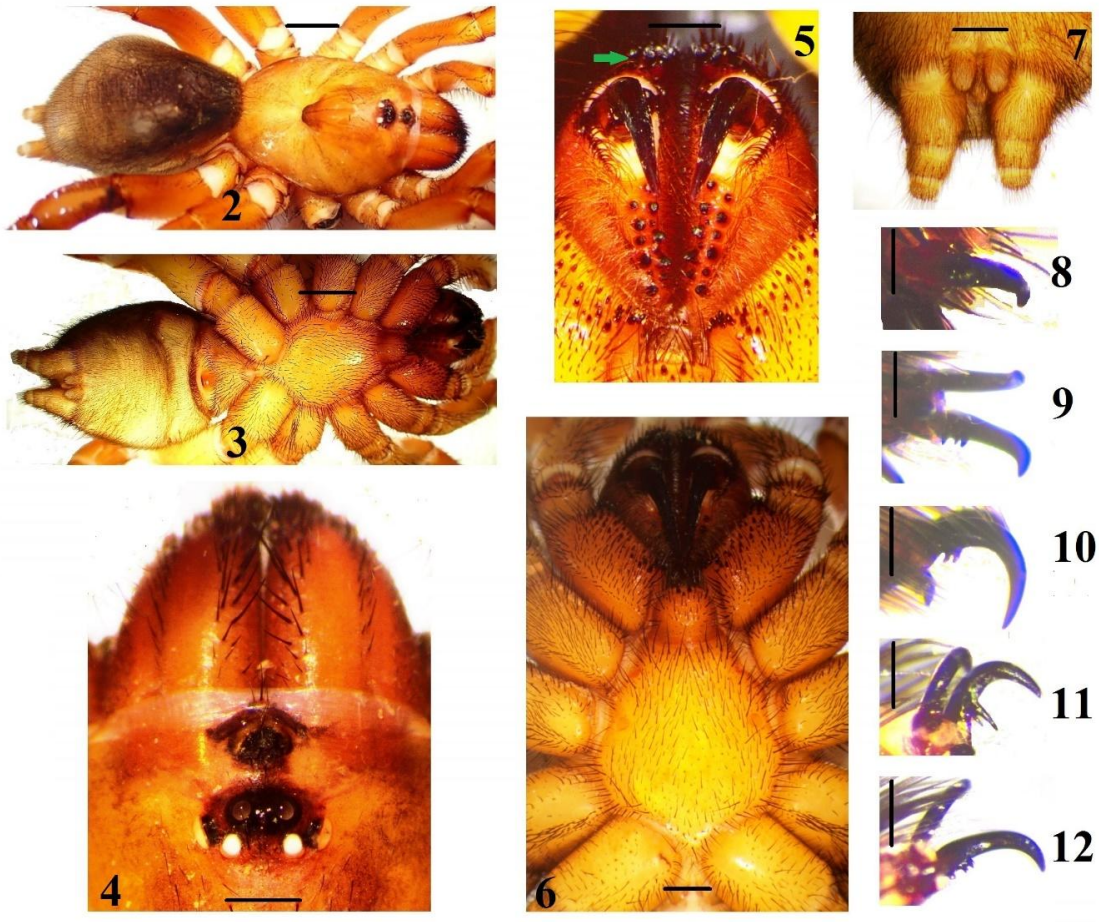
Idiops Perty, 1833

Idiops medini Pratihar & Das sp. nov. (Figs. 1-14)

Type specimen: Holotype ♀, (IPUM), INDIA. 19.viii.2020, Nayagram, Jhargram, West Bengal 22º03'21.51"N, 87º09'06.72"E, coll. S. Pratihar and C. Dandapat, IPU-20-ARA-1594.

Diagnosis: This new species (Fig. 1) resembles *I. crassus* Simon, 1884 having coxa IV without spinules on ventral side (Fig. 3), tibia III longer than wide, ALE largest among all eyes (Fig. 4) and labium with three teeth (Fig. 6), but differs from *I. crassus* in: ocular tubercle not elevated in front (Fig. 2) (elevated in *I. crassus*), eye inter-spaces (AMEs more than one diameter apart, PMEs about two diameters apart and less than one from the laterals vs. AMEs about one diameter apart, PMEs about four diameters apart and less than two from the laterals in case of *I. crassus*), and leg formula (4132 vs. 4123 in case of *I. crassus*) (Simon, 1884; Pickard-Cambridge, 1889; Pocock, 1900). The new species also differs from all other congeners in having a distinct female genitalia with two lateral lobes and more or less inverted bottle-shaped receptacles that opens ventrally into a prominent wide sclerotized basal area (Figs. 13-14).

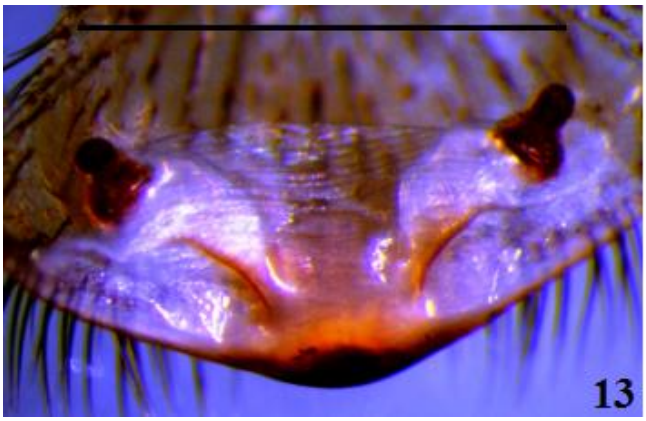
Etymology: The species epithet is a name in apposition taken from the type locality belonging to undivided Paschim Medinipur.



Figs. 2-12. *Idiops medini* Pratihar & Das sp. nov., ♀ holotype. 2-3. Habitus. 2. dorsal view. 3. ventral view. 4. Eyes and chelicerae, dorsally. 5. Chelicerae (terminal stumpy spines marked by an arrow). 6. Sternum, labium and maxillae. 7. Spinnerets. 8. Claw of pedipalp. 9-12. Claw of leg. 9. leg I. 10. leg II. 11. leg III. 12. leg IV. (Scale: 2 mm [2-3], 1 mm [4-7], 0.2 mm [8-12]).

Description of female holotype (IPU-20-ARA-1594): Total length 15.58; carapace 6.79 long, 6.07 wide; abdomen 8.79 long, 5.49 wide. Colour in life: carapace silvery-grey and abdomen dorsally uniformly grey (Fig. 1). Colour in alcohol: carapace greyish-yellow with black patches encircling ALEs and posterior eye group, light reticulate marking on carapace (Figs. 1,4), chelicerae, legs, and pedipalp yellowish-brown, abdomen dorsally greyish-yellow, mottled with scattered whitish spots, ventrally uniformly greyish-yellow with uneven greyish shades at margins (Figs. 2-3). Carapace: rough, reticulate, broader between legs II and gradually narrowing posteriorly, clypeus prominent, caput with distinct mound between fovea and posterior eye group, rough, two long bristles and few short bristles on mound, fovea deep, procurved, U-shaped (Figs. 1-3). Eyes: eight in three rows, ALE situated far away from AME on clypeal edge (Figs. 2,4), ocular group 1.49 long, 1.49 wide, MOQ 0.60 long, front width 0.65, back width 0.85, posterior row procurved (Fig. 4). Eye diameter and inter-distances: AME 0.21, PME 0.22, ALE 0.46, PLE 0.33; ALE-AME 0.61, AME-AME 0.29, PME-PME 0.45, ALE-PLE 0.78, and PLE-PME 0.16. Chelicerae: dorsally with glabrous bands lined by bristles, rastellum conspicuous, anteriorly raised on high triangular mound, surrounded by many long and

short stiff bristles (Fig. 2), ventrally sixteen thick cylindrical spines just above each fang arranged in a triangle (marked by green arrow), promargin with eight teeth and retromargin with six teeth (Fig. 5). Maxillae: 2.7 long, 1.5 wide, yellowish-brown with distinct anterior lobe, covered with long bristles, ca. 30 cuspules distributed towards anterior edge (Fig. 6). Labium: 1.11 long, 1.36 wide, yellowish-brown, covered with black hairs throughout, anterior edge with long bristles, with three teeth (two small and one very small in-between them), labiosternal joint procurved (Fig. 6). Sternum: 4.28 long, 3.84 wide, yellowish-brown, covered with black hairs, margins with long bristles, broader between coxae III, elevated in centre, sloping laterally at posterior end, posterior angle acute, with two pairs of sigilla, anterior pair marginal, median pair slightly away from margin, posterior sigilla absent (Figs. 3,5).



Figs. 13-14. *Idiops medini* Pratihar & Das sp. nov., ♀ holotype, spermathecae. (Scale: 0.1 mm.)

Abdomen: oval, elevated medially, uniformly covered with short black hairs both dorsally and ventrally, cuticle appears leathery and little rough (Figs. 1-2). Legs: scopulae absent on tarsi of all legs and pedipalp, tibia III longer than wide, dorsally one conspicuous yellowish-white band for length of patella and tibia IV lined by long black hairs (Fig. 2), coxae of all legs covered with short hairs (Fig. 3). Leg measurements (femur, patella, tibia, metatarsus, tarsus, total): leg I: 4.87, 3.12, 2.38, 2.12, 0.89, 13.38; leg II: 4.64, 2.71, 2.23, 2.06, 1.26, 12.90; leg III: 4.14, 2.82, 1.92, 2.50, 1.83, 13.21; leg IV: 5.35, 3.66, 3.71, 3.97, 2.09, 18.78; pedipalp: 4.34, 2.73, 2.82, - , 2.78, 12.67; leg formula 4132. Spines: present on legs, more on sides, I: ti, v = 1, mt, p = 11, r = 12, v = 4, ta, p = 4, r = 5, v = 1, II: ti, p = 6, r = 2, mt, p = 9, r = 6, v = 2, ta, p = 6, r = 5, v = 2; III: pa, d = 4, r = 6, ti, p = 6, r = 6, mt, p = 8, r = 10, v = 2, ta, p = 5, r = 6, v = 6; IV: pa, p = 7, mt, p = 6, ta, p = 3; pedipalp: mt, p = 14, r = 10, ta, p = 11, r = 16, v = 2. Trichobothria: clavate absent, filiform, I: fe = 27, pa = 20, mt = 4; II: fe = 17, pa = 6, ti = 15; III: fe = 17, pa = 11, ti = 6, mt = 29, ta = 9; IV: fe = 17, pa = 4, ti = 6, mt = 23, ta = 11; palp: fe = 13. pa = 4. Claws: pedipalp with single smooth claw, all legs with three claws, unpaired claw smallest and smooth, paired claws of legs I-III are of equal sizes and IV of unequal size, teeth on paired claws of legs: 1st with 3 small subequal teeth, 2nd with 2 small subequal teeth, 3rd with 2 unequal teeth, 4th the larger one with 3 unequal bifid teeth and the smaller one smooth (Figs. 8-12). Spinnerets: yellowish-brown, PMS 0.78 long, digitiform and covered with brown hairs, PLS 2.28 long, apical segment domed and covered with brown hairs (Fig. 7). Spermathecae: two small tubular sclerotized porous lobes facing away from each other and unevenly sclerotized at their basal half forming unequal arm-like lateral lobes that continue with receptacles on each side. The receptacles are wide

(ducts are widely separated) at their base and narrows down gradually giving appearance of a more or less inverted bottle and each opens ventrally into a prominent wide sclerotized basal area. Receptacles and basal area are covered with a transparent membrane (Figs. 13-14).

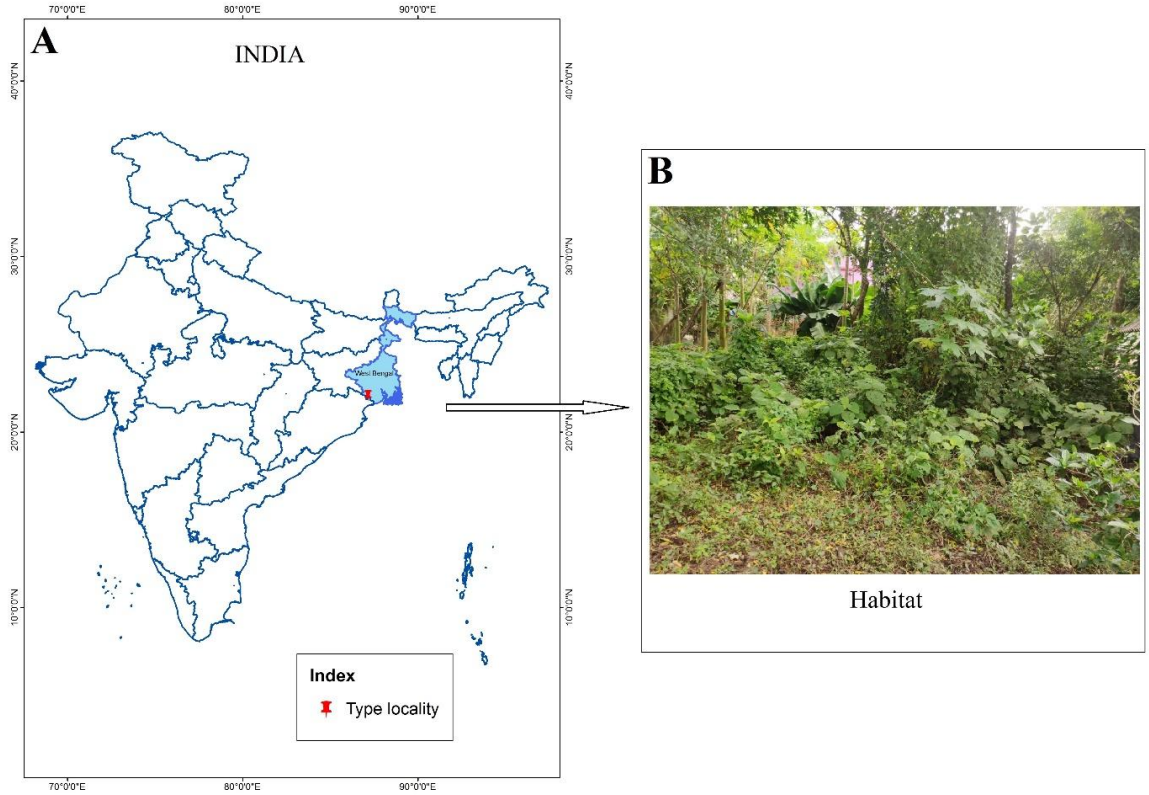


Fig. 15. *Idiops medini* Pratihar & Das sp. nov., ♀ holotype.
A. type locality map. B. habitat.

Distribution: West Bengal, India (type locality) (Fig. 15A).
Natural History: This spider was found on road side cut in an open woody plantation area (Fig. 15B).

Acknowledgments

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***Idiops medini* Pratihar & Das, 2020**
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A new record for the spider fauna of Turkey: *Hypomma cornutum* (Blackwall, 1833) (Araneae: Linyphiidae)

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Abstract

In this short paper, the characteristic features and photographs of *Hypomma cornutum* (Blackwall, 1833) from Turkey are presented. It is a new record from Turkey. This increases the total number of Linyphiidae recorded in Turkey to 117 species.

Keywords: Araneae, Linyphiidae, *Hypomma cornutum*, new record, Turkey.

Introduction

The Linyphiidae Blackwall, 1859 is one of the largest families of spiders with 4668 described species in 618 genera (World Spider Catalog, 2020). A total of 116 species in 68 genera of Linyphiidae are known in Turkey (Danışman *et al.*, 2019). This paper deals with the characteristic features and distribution of *Hypomma cornutum* (Blackwall, 1833) adding a new linyphiid species to the araneo-fauna of Turkey.

Material and Methods

The present study is based on the material collected in 2014 from Sinop in Turkey. The specimens were found under stones, bushes and leaf litter and collected by means of shifter and hand aspirator during the daytime. Specimens were preserved in 70% ethanol. The identification was made with a Leica S8APO microscope and pictures were taken by means of a Leica DC 160 camera. Identification depended on descriptions and drawings of: Tyschchenko (1971), Roberts (1987), Heimer & Nentwig (1991), Jäger

(2006), and Bellvert Bantí (2016). Collected and examined specimens are deposited in the collection of the Zoological Museum of Kastamonu University (KUZM).

Results

Material examined: *Hypomma cornutum* (Blackwall, 1833): 1♀ 1♂, Turkey, Sinop Province, Sarıkum, (42º00'25.4"N, 34º56'27.7"E, 19 m), 01.05.2014, leg. H. Koç.
Morphology: Body length male: 2.1 mm, female: 2.4 mm. Male and female prosoma colour: brown-red brown, cephalic area high resembling two attached pieces. Legs yellow-orange. Opisthosoma brown to dark brown (Fig. 1). Palp: tibial apophysis rounded and short, cymbium margin with notches, embolus conspicuous and curled. Epigyne: medially rounded with septum structure protruding, underlying structures visible.
Habitat: collected from leaf litter.
Distribution: Palaearctic: Europe and Russia (Europe to South Siberia) (World Spider Catalog, 2020).

Fig. 1. *Hypomma cornutum* (Blackwall, 1833). A-B. Male. A. Habitus, dorsal view. B. Palpal organ. C-D. Female. C. Habitus, dorsal view. D. Epigyne, ventral view.

Discussion

The studies on the spiders in our country, which contains faunal and floral diversity in terms of geographical location, are still new and are gaining momentum. The spider fauna of Turkey is represented by 1129 species belonging to 54 families and 349 genera (Danışman *et al.*, 2019). In family Linyphiidae, 116 species of 68 genera were recorded from our country, including only *Hypomma bituberculatum* (Wider, 1834) from

genus *Hypomma*. Although Linyphiidae has a very large number of species and is one of the most common groups in nature they are difficult to obtain because they are tiny and can be concealed very well in vegetation.

Including the new record listed above, the total number of linyphiid species recorded in Turkey now is 117 species. The morphometric measurements and other characteristic features of the Turkish specimens of *Hypomma cornutum* are not different from the European specimens.

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Three new records of spider genera from Turkey (Araneae: Linyphiidae, Cybaeidae)

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Abstract

In this short paper, the characteristic features and photographs of *Minicia marginella* (Wider, 1834) and *Trichoncus hackmani* Millidge, 1955 of family Linyphiidae and *Tuberta maerens* (O. Pickard-Cambridge, 1863) of family Cybaeidae are presented as new records of both genera and species from Turkey. This increases the total number of Linyphiidae recorded in Turkey to 119 species in 70 genera and Cybaeidae to 5 species in 4 genera.

Keywords: Araneae, Linyphiidae, Cybaeidae, new records, Turkey.

Introduction

The world spider fauna comprises more than 48.700 described species (World Spider Catalog, 2020). To date, the total number of species of Araneae recorded from Turkey is 1129, belonging to 349 genera and 54 families (Danışman *et al.*, 2019).

Minicia and *Trichoncus* are genera of family Linyphiidae which comprises very small spiders commonly known as sheet weavers, money spiders or dwarf spiders. *Tuberta* is a genus of araneomorph spiders in the family Cybaeidae, and was first described by Simon in 1884. This genus contains only two species. Family Cybaeidae is a relatively small family with 268 species belong to 20 genera and has a worldwide distribution (World Spider Catalog, 2020).

New records of three genera and three species of spiders from Turkey are presented for *Minicia marginella* (Wider, 1834), *Trichoncus hackmani* Millidge, 1955 and *Tuberta maerens* (O. Pickard-Cambridge, 1863). Their morphology is briefly described and illustrated.

Material and Methods

This study was conducted on the spider samples collected during field studies in the Sinop region in 2014. Sample collection was done by hand aspirator (among and under stones), sweeping net and beating net (from bushes). Specimens were preserved in a mixture of 70% alcohol + 5% glycerine. The identifications were made with a Leica S8APO microscope and pictures were taken by means of a Leica DC 160 camera. Identification references are: Heimer & Nentwig (1991), Roberts (1985, 1987), and Tyschchenko (1971). Collected and examined specimens are deposited in the collection of the Zoological Museum of Kastamonu University (KUZM).

Results

1. ***Minicia marginella*** (Wider, 1834)
Material examined: 3♀♀ 1♂, Turkey, Sinop Province, Durağan District, (41º30'56.9"N, 35º06'03.9"E, 1243 m), 31.05.2014, leg. E. Etirli.
Morphology: Male (Fig. 1A) body length: 1.3 mm, prosoma and opisthosoma in yellow and brown colours, cephalic region is raised in the ocular region. Opisthosoma dorsally with dark median stripe with irregular longitudinal line. Palp (Figs. 1D-E) with hook-shaped apophysis; embolus curled; paracymbium teeth less.

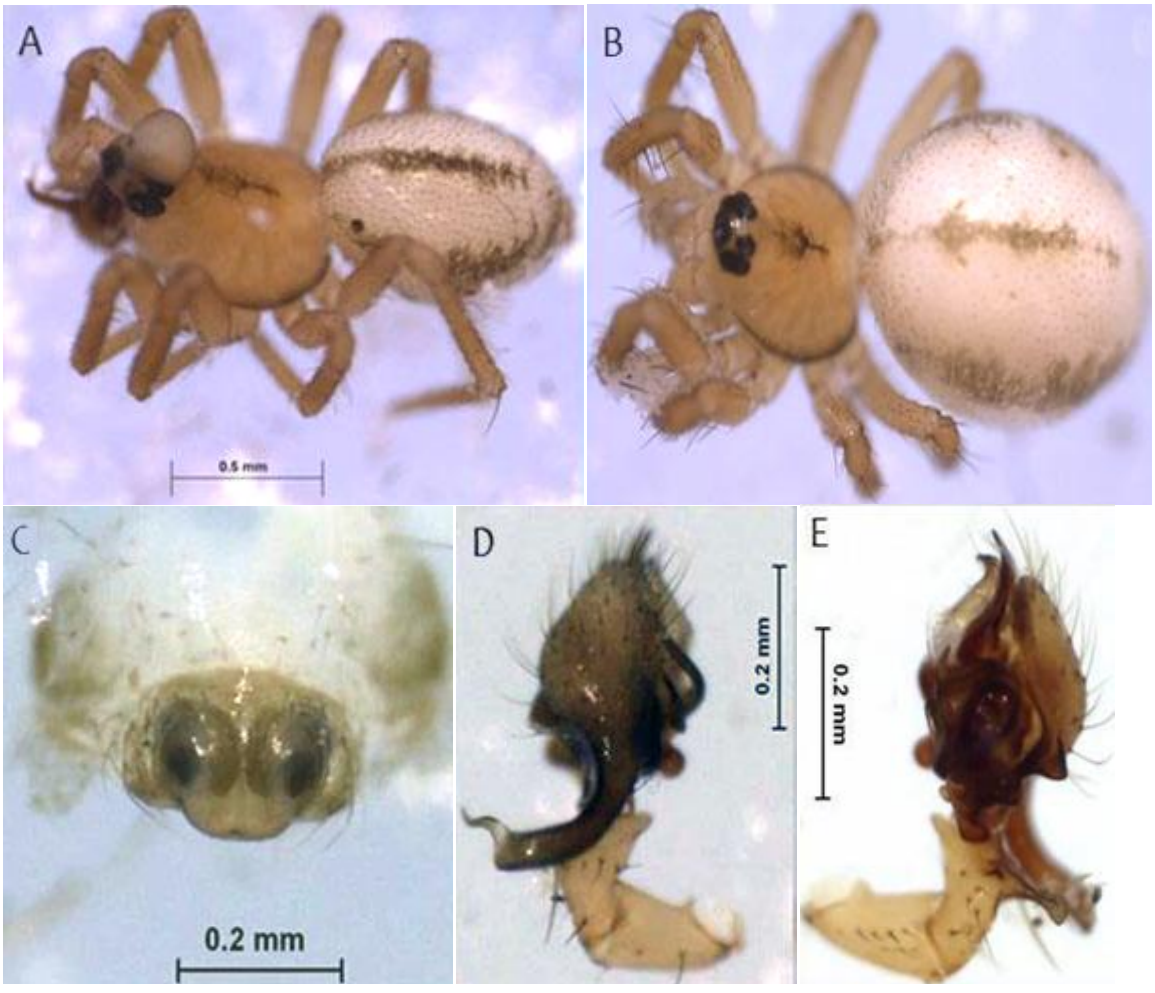

Fig. 1. *Minicia marginella* (Wider, 1834). A,D-E. Male. A. Habitus, dorso-lateral view. D-E. Pedipalp. B-C. Female. B. Habitus, dorsal view. C. Epigyne, ventral view.

Female (Fig. 1B) body length: 1.5 mm, prosoma and opisthosoma in yellow and brown colours, ocular region normal. Sternum smooth. Opisthosoma dorsally with dark median stripe with irregular longitudinal line like male. Fovea clearly visible as darkened groove. Epigyne protruded and underlying structures visible (Fig. 1C).
Habitat: Collected from forest ground.
Distribution: Palaearctic: Europe, Caucasus, Russia (Europe to Far East) (World Spider Catalog, 2020).

2. ***Trichoncus hackmani*** Millidge, 1955
Material examined: 1♂, Turkey, Sinop Province, Sarıkum, (42º01'28.7"N, 34º54'57.9"E, 10 m) 04.05.14, leg. H. Koç.
Morphology: Male (Fig. 2A) body length: 1.8 mm, prosoma brown to dark brown. Opisthosoma dark brown. Legs yellow brown. Male cephalic area high like a tubercle. Clypeus protruding. Palp (Figs. 2B-C): embolus short, terminal apophysis like spiral.
Habitat: Collected from bushes.
Distribution: Europe (World Spider Catalog, 2020).

Fig. 2. *Trichoncus hackmani* Millidge, 1955, male. A. Habitus, lateral view. B-C. Palp. B. lateral view. C. ventral view.

3. ***Tuberta maerens*** (O. Pickard-Cambridge, 1863)
Material examined: 1♂, Turkey, Sinop Province, Ayancık District. (41º52'52.0"N, 34º46'01.0"E, 697 m) 14.08.2014, leg. H. Koç.
Morphology: Male (Fig. 3) body length: 1.6 mm, prosoma brown-yellow with dark radial line. Sternum light brown, opisthosoma dark brown. Legs are yellowish. Ocular region curved. Palp (Figs. 3C-D): embolus very long, reaches to tibia; tegular lamella broadly and tapering towards the tip; conductor with large terminal part.
Habitat: Collected from under stones.
Distribution: Europa to Azerbaijan (World Spider Catalog, 2020).

Discussion

In this study, we present new records of three species of the spider fauna of Turkey, which also represent three new records of genera that we encountered during recent field surveys from different regions of Turkey. However, Turkish spiders have been poorly studied. Despite there is an increase in studies on Turkish spiders during

recent years, there are still many regions of the country that remain insufficiently investigated.

While *Minicia* and *Trichoncus* are genera of family Linyphiidae, genus *Tuberta* belongs to family Cybaeidae; it was transferred from Agelenidae to Hahniidae (Cryphoecinae) by Lehtinen (1967) and to Cybaeidae by Wheeler *et al.* (2017).

This addition of *Minicia marginella* (Wider, 1834), *Trichoncus hackmani* Millidge, 1955, *Tuberta maerens* (O. Pickard-Cambridge, 1863) and their genera to the spider fauna of Turkey increases the total number of Linyphiidae recorded in Turkey to 119 species in 70 genera and Cybaeidae to 5 species in 4 genera.

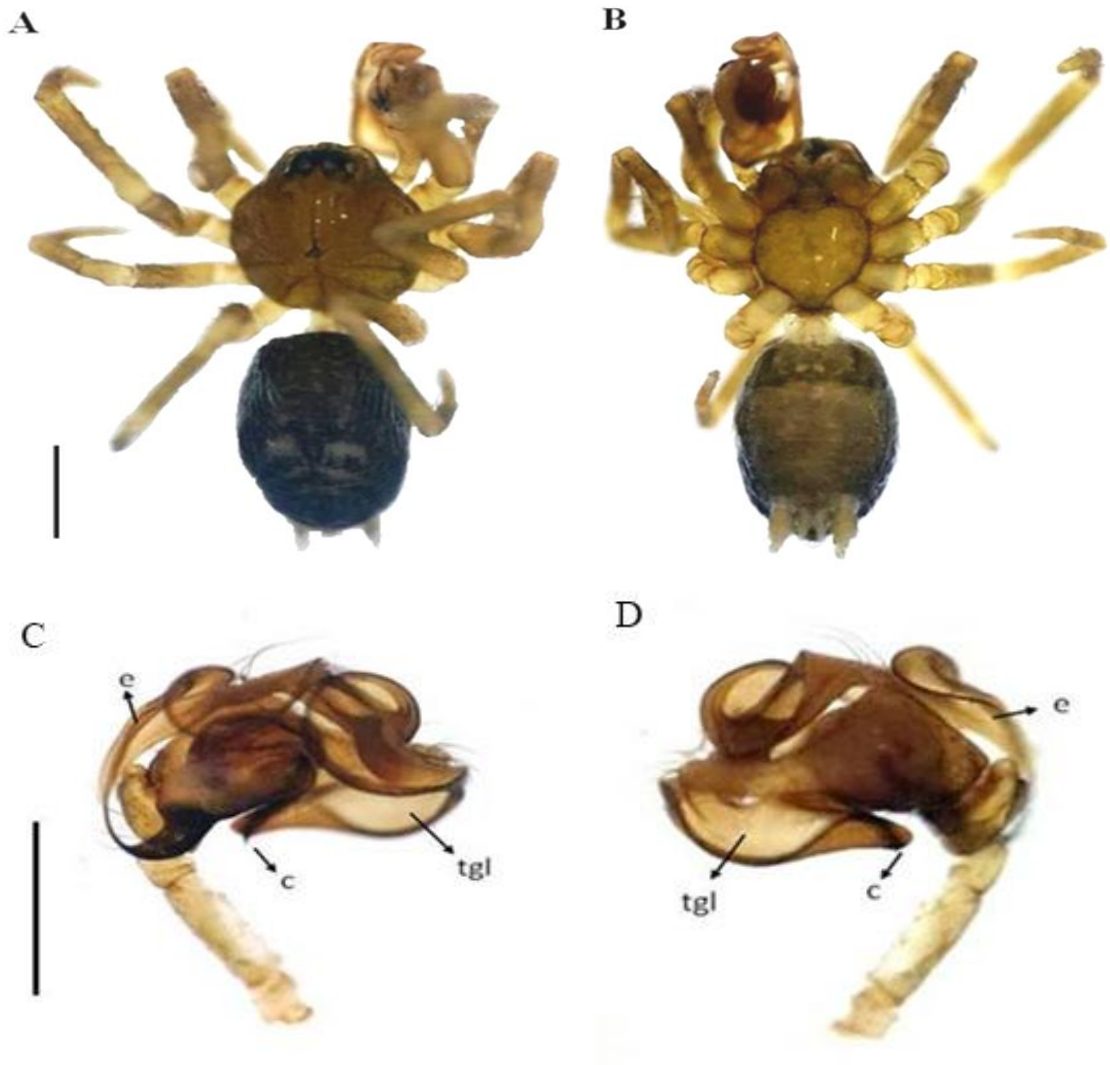

Fig. 3. *Tuberta maerens* (O. Pickard-Cambridge, 1863), male. A-B. Habitus. A. dorsal view. B. ventral view (scale = 1 mm). C-D. Left palp, prolateral and retrolateral views (scale = 0.5 mm) (c = conductor, e = embolus, tgl = tegular lamella).

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The spider fauna of Aladağ District (Adana) in southern Anatolia, Turkey

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Abstract

This study was done in Aladağ district in Adana Province in south of Turkey. Spiders were collected from field using aspirator, sweeping net, and pitfall traps in the study area during two years, beginning from April 2017 to July 2019. As a result of identification of these specimens, a total of 91 spider species belonging to 74 genera in 24 families were recorded from the study area. All specimens were labelled and preserved as museum material in Arachnology Museum of Niğde Ömer Halisdemir University.

Keywords: Spider, Fauna, Aladağ district, Turkey.

Introduction

The spider fauna of Turkey is increasing in the recent years. Despite this increase, there are still many regions of the country that remain insufficiently investigated. Up to now, 48903 species of 4184 genera of spiders have been described in the world (World Spider Catalog, 2020). There are only 1117 species, belonging to 52 families known from Turkey (Demir & Seyyar, 2017). On this study area, there is only one published study by Seyyar *et al.* (2019). The aim of this study is to present the spider diversity of Aladağ district.

Material and Methods

All specimens were collected from Aladağ district in Adana Province (Fig. 1) using aspirator, sweeping net, and pitfall traps from 16 localities in the study area during

two years, beginning from April 2017 to July 2019. The identification was made by means of a SZX61 Olympus stereomicroscope. Museum materials were used for the species comparison and identification. The specimens were labelled and preserved as museum material in Arachnology Museum of Niğde Ömer Halisdemir University (NOHUAM).

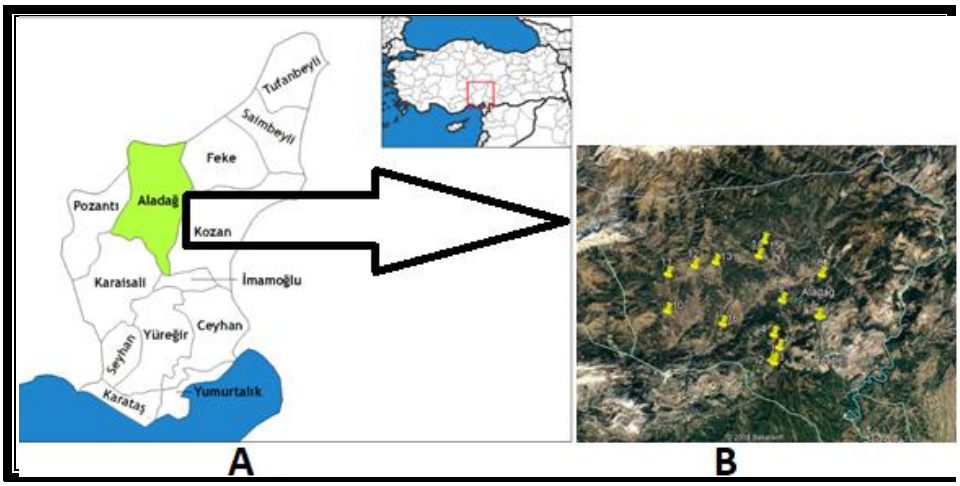

Fig. 1. Location of the study area, Aladağ district in Adana Province, in Turkey (A) and the collecting localities (B).

List of collecting localities:

1. Aladağ, Madenli village (37°27'44"N, 35°19'36"E), 957m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
2. Aladağ, Madenli village (37°27'62"N, 35°19'24"E), 952m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
3. Aladağ, Madenli village (37°27'98"N, 35°19'84"E), 961 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
4. Mavriyan village (37°29'79"N, 35°19'01"E), 1262 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
5. Karaküre village (37°28'31"N, 35°19'45"E), 1240 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
6. Hasandede village (37°30'49"N, 35°23'26"E), 1076 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
7. Meydan-Aladağ (37°30'54"N, 35°23'05"E), 1088 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
8. Aladağ (near the centre) (37°33'25"N, 35°23'55"E), 806 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
9. İbrişim village (37°31'87"N, 35°19'33"E), 896 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
10. Gerdibi village (37°30'28"N, 35°9'56"E), 915 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
11. Gerdibi village (37°33'60"N, 35°9'42"E), 918 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
12. Büyüksofulu village (37°33'30"N, 35°11'23"E), 1082 m a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
13. Kıcak village (37°34'01"N, 35°13'97"E), 995 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
14. Kökez village (37°34'63"N, 35°17'94"E), 824 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
15. Dölekli village (37°35'13"N, 35°17'26"E), 808 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.
16. Posyağbasan village (37°29'40"N, 35°14'54"E), 833 m, a) 15.IV.2017; b) 16.VI.2017; c) 02.IX.2017; d) 04.V.2018; e) 07.VII.2018; f) 12.X.2018; g) 10.VI.2019; h) 01.VII.2019.

Results and Discussion

A total of 91 spider species belonging to 74 genera in 24 families were determined from the study area (Table 1). Most species rich families were Gnaphosidae (21), Salticidae (13), Thomisidae (10), Lycosidae (8), and Araneidae (6). According to the results of this study, the spider diversity in the study area contains nearly 10% at the species level of 24 families of Turkish spiders (Fig. 2).

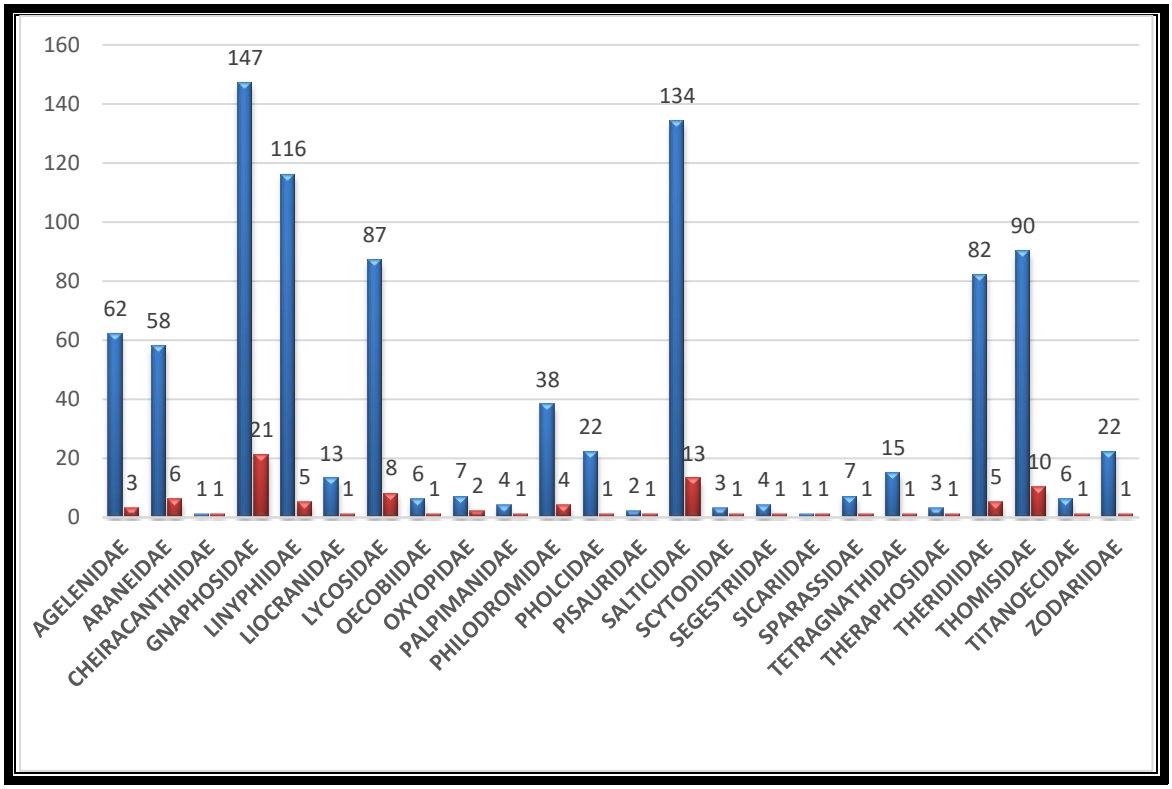

Fig. 2. Comparison of species numbers of 24 spider families in Turkey (blue) and the study area, Aladağ district (red).

Table 1. The spider list of the study area, Aladağ district.

Family	**AGELENIDAE**
1	*Agelena labyrinthica* (Clerck, 1757)
2	*Maimuna vestita* (C.L. Koch, 1841)
3	*Tegenaria argaeica* Nosek, 1905
Family	**ARANEIDAE**
1	*Aculepeira ceropegia* (Walckenaer, 1802)
2	*Araneus pallidus* (Olivier, 1789)
3	*Araniella cucurbitina* (Clerck, 1757)
4	*Argiope lobata* (Pallas, 1772)
5	*Larinioides cornutus* (Clerck, 1757)
6	*Neoscona adianta* (Walckenaer, 1802)
Family	**CHEIRACANTHIIDAE**
1	*Cheiracanthium mildei* L. Koch, 1864
Family	**GNAPHOSIDAE**
1	*Anagraphis pallens* Simon, 1893

2	*Callilepis nocturna* (Linnaeus, 1758)
3	*Civizelotes caucasius* (L. Koch, 1866)
4	*Drassodes lacertosus* (O. Pickard-Cambridge, 1872)
5	*Drassodes lapidosus* (Walckenaer, 1802)
6	*Gnaphosa dolosa* Herman, 1879
7	*Gnaphosa opaca* Herman, 1879
8	*Haplodrassus invalidus* (O. Pickard-Cambridge, 1872)
9	*Haplodrassus signifer* (C.L. Koch, 1839)
10	*Lasophorus zografae* Chatzaki, 2018
11	*Marinarozelotes malkini* (Platnick & Murphy, 1984)
12	*Micaria coarctata* (Lucas, 1846)
13	*Nomisia aussereri* (L. Koch, 1872)
14	*Nomisia conigera* (Spassky, 1941)
15	*Nomisia exornata* (C.L. Koch, 1839)
16	*Nomisia ripariensis* (O. Pickard-Cambridge, 1872)
17	*Pterotricha lentiginosa* (C.L. Koch, 1837)
18	*Setaphis parvula* (Lucas, 1846)
19	*Zelotes cingarus* (O. Pickard-Cambridge, 1874)
20	*Zelotes longipes* (L. Koch, 1866)
21	*Zelotes subterraneus* (C.L. Koch, 1833)
Family LIOCRANIDAE	
1	*Mesiotelus scopensis* Drensky, 1935
Family LINYPHIIDAE	
1	*Frontinellina frutetorum* (C.L. Koch, 1835)
2	*Lepthyphantes leprosus* (Ohlert, 1865)
3	*Linyphia triangularis* (Clerck, 1757)
4	*Megalepthyphantes nebulosus* (Sundevall, 1830)
5	*Neriene peltata* (Wider, 1834)
Family LYCOSIDAE	
1	*Alopecosa pulverulenta* (Clerck, 1757)
2	*Arctosa cinerea* (Fabricius, 1777)
3	*Hogna radiata* (Latreille, 1817)
4	*Pardosa agrestis* (Westring, 1861)
5	*Pardosa hortensis* (Thorell, 1872)
6	*Pardosa monticola* (Clerck, 1757)
7	*Pardosa proxima* (C.L. Koch, 1847)
8	*Wadicosa fidelis* (O. Pickard-Cambridge, 1872)
Family OECOBIIDAE	
1	*Uroctea durandi* (Latreille, 1809)
Family OXYOPIDAE	
1	*Oxyopes heteropthalmus* (Latreille, 1804)
2	*Oxyopes lineatus* Latreille, 1806
Family PALPIMANIDAE	
1	*Palpimanus gibbulus* Dufour, 1820
Family PHILODROMIDAE	
1	*Philodromus cespitum* (Walckenaer, 1802)
2	*Philodromus margaritatus* (Clerck, 1757)
3	*Thanatus atratus* Simon, 1875
4	*Thanatus oblongiusculus* (Lucas, 1846)

Family	**PHOLCIDAE**
1	*Pholcus phalangioides* (Fuesslin, 1775)
Family	**PISAURIDAE**
1	*Pisaura mirabilis* (Clerck, 1757)
Family	**SALTICIDAE**
1	*Aelurillus luctuosus* (Lucas, 1846)
2	*Ballus chalybeius* (Walckenaer, 1802)
3	*Chalcoscirtus nigritus* (Thorell, 1875)
4	*Cyrba algerina* (Lucas, 1846)
5	*Evarcha falcata* (Clerck, 1757)
6	*Heliophanus edentulus* Simon, 1871
7	*Philaeus chrysops* (Poda, 1761)
8	*Phlegra bresnieri* (Lucas, 1846)
9	*Phlegra fasciata* (Hahn, 1826)
10	*Plexippus paykulli* (Audouin, 1825)
11	*Pseudeuophyrs obsoleta* (Simon, 1868)
12	*Salticus scenicus* (Clerck, 1757)
13	*Talavera aequipes* (O. Pickard-Cambridge, 1871)
Family	**SCYTODIDAE**
1	*Scytodes thoracica* (Latreille, 1802)
Family	**SEGESTRIIDAE**
1	*Segestria bavarica* C.L. Koch, 1843
Family	**SICARIIDAE**
1	*Loxosceles rufescens* (Dufour, 1820)
Family	**SPARASSIDAE**
1	*Eusparassus walckenaeri* (Audouin, 1825)
Family	**TETRAGNATHIDAE**
1	*Tetragnatha obtusa* C.L. Koch, 1837
Family	**THERAPHOSIDAE**
1	*Chaetopelma olivaceum* (C.L. Koch, 1841)
Family	**THERIDIIDAE**
1	*Asagena phalerata* (Panzer, 1801)
2	*Enoplognatha mandibularis* (Lucas, 1846)
3	*Episinus truncatus* Latreille, 1809
4	*Euryopis laeta* (Westring, 1861)
5	*Steatoda paykulliana* (Walckenaer, 1806)
Family	**THOMISIDAE**
1	*Bassaniodes caperatus* (Simon, 1875)
2	*Bassaniodes pseudorectilineus* (Wunderlich, 1995)
3	*Diaea livens* Simon, 1876
4	*Heriaeus graminicola* (Doleschall, 1852)
5	*Pistius truncatus* (Pallas, 1772)
6	*Synema globosum* (Fabricius, 1775)
7	*Thomisus onustus* Walckenaer, 1805
8	*Tmarus stellio* Simon, 1875
9	*Xysticus edax* (O. Pickard-Cambridge, 1872)
10	*Xysticus laetus* Thorell, 1875
Family	**TITANOECIDAE**
1	*Nurscia albomaculata* (Lucas 1846)

Family ZODARIIDAE	
1	*Zodarion thoni* Nosek, 1905

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World Spider Catalog 2020. *World Spider Catalog*. Version 21.5. Natural History Museum Bern, online at http://wsc.nmbe.ch, accessed on 20.10.2020.

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A new record of *Ozyptila lugubris* (Kroneberg, 1875) (Araneae: Thomisidae) from Turkey

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Abstract

Ozyptila lugubris (Kroneberg, 1875) is recorded for the first time from Turkey on the basis of a male specimen collected from Kelkit Valley. This species can be easily distinguished from other Turkish congeners by the shape of male palp.

Keywords: Araneae, Thomisidae, *Ozyptila*, Turkey.

Introduction

Thomisidae, commonly called the crab spiders, is a big spider family comprising 169 genera and 2150 species worldwide, of which 90 species of 14 genera are known from Turkey. Being a genus of this family, *Ozyptila* Simon, 1864 is currently containing 100 species distributed all over the world; among them, twelve species have been recorded in Turkey (Demir & Seyyar, 2017; World Spider Catalog, 2020).

General appearance of the leaf litter crab spider genus *Ozyptila* closely resemble the more common genus *Xysticus*. The members of this genus have only two pairs of ventral spines on tibia I and II, and the body is covered with clavate (club-shaped) hairs to differ from those of *Xysticus* species. They are found in leaf litter, detritus, under stones, wood and rarely under low bushes.

This paper reports the first country record of *Ozyptila lugubris* (Kroneberg, 1875) based on a male specimen collected from Kelkit Valley, Turkey.

Material and Methods

Illustrations were made by a Nikon SMZ-U stereomicroscope with drawing tube. The studied specimen is deposited in the Arachnology Museum of Niğde Ömer Halisdemir University, Niğde, Turkey (NOHUAM). Identification of the species depended on Marusik & Logunov (1990).

Fig. 1. Locality of *Ozyptila lugubris* (Kroneberg, 1875) in Kelkit Valley (Sivas Province).

Results

Ozyptila lugubris (Kroneberg, 1875) (Fig. 2)
Material Examined: 1♂ (NOHUAM), TURKEY: Sivas Province: Suşehri District, Elmaseki village (40°5'8.32"N, 38°5'36.66"E), 1580m, 03.V.2019, leg. H. Demir.

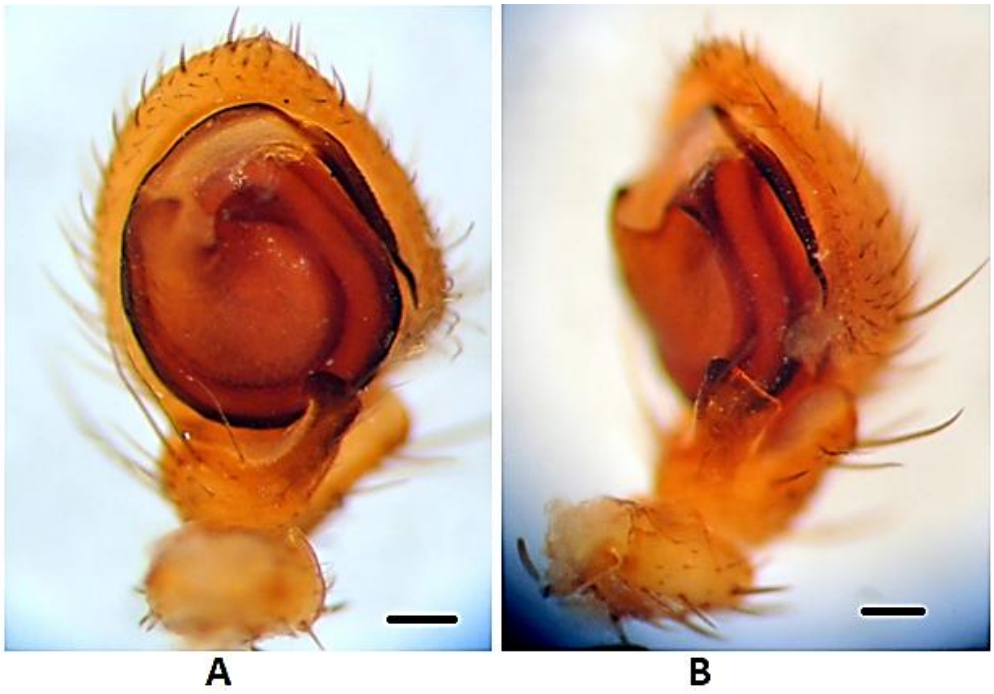

Fig. 2. *Ozyptila lugubris* (Kroneberg, 1875) ♂, left palp. A. ventral view; B. retrolateral view. (Scale bar: 0.1 mm)

Description: See Marusik & Logunov (1990); male palp as in Fig. (2).
World distribution: Eastern Europe, Caucasus, Russia (Europe to West Siberia), Kazakhstan, Iran, Central Asia (World Spider Catalog, 2020).

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Overwintering spider biodiversity in pistachio orchards of the Euphrates Valley in Turkey (Arachnida: Araneae)

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Abstract

This study aimed to determine the overwintering spider (Arachnida: Araneae) fauna by artificial overwintering shelters in five pistachio orchards of the Euphrates Valley in Şanlıurfa Province of Turkey during 2017-2018 winter periods. For this purpose, five pistachio orchards from different locations were selected in the Euphrates Valley and artificial overwintering habitats were designed on ten trees in each orchard. As a result of the study, a total of 20 species belonging to 20 genera and 11 families of order Araneae were determined in those artificial overwintering shelters.

Keywords: Araneae, Spiders, Pistachio, Overwintering, Euphrates, Turkey.

Introduction

Pistachio is a strategic crop that grows in appropriate microclimates of 30-45° parallels of the northern and southern hemispheres in the world (Tekin *et al.*, 2020). Turkey is an important producer of pistachio (*Pistacia vera* L.) nuts. Turkey is the third biggest producer of pistachio after Iran and USA (FAO, 2019). Southeast Anatolian Region, including Euphrates Valley in Şanlıurfa Province, supplies 90% of the pistachio production of Turkey (TUIK, 2019). Euphrates Valley has a special role for cultivation of pistachio in Turkey. Unfortunately, there are many pests in the pistachio orchards that negatively affect pistachio cultivation. It has been reported that a large number of harmful and beneficial insect species have been detected in pistachio orchards and some of the harmful insects have caused economic damage (Mart *et al.*, 1995). In addition, there are

many beneficial insect species as predators or parasitoids in pistachio orchards. Bolu (2004) identified 22 predatory coccinellid species in pistachio orchards of southeastern provinces.

Spiders are represented around the world with 128 families, 4184 genera and 48,864 species (World Spider Catalog, 2020). It is known that many spider species are predators on insect pests in the nature and they have an important role on the natural balance. Bayram & Allahverdi (1999) reported that individuals belonging to the class Arachnida preferred winter traps and spent the winter with a rate of 99.15%. Many studies have been performed on spider fauna of cereal (Luczak, 1975; Jones, 1976; Kumar & Velusamy, 1997; Danışman *et al.*, 2007), soybean (Ferguson *et al.*, 1984), alfalfa (Bayram *et al.*, 1999), pomegranate (Öztürk *el al.*, 2013), olive (Kaplan *et al.*, 2017), cotton (Bayram *et al.*, 2000), and tobacco (Bayram *et al.*, 1998) fields and some orchards (Ghavami, 2006) in the Middle East, Western Asia, and Far East countries.

It was understood from the literature related to spider fauna that there was no studies on spider fauna in pistachio orchards in the Euphrates Valley in Turkey. This study aimed to determine the overwintering spider (Arachnida: Araneae) biodiversity by artificial overwintering shelters in pistachio orchards of the Euphrates Valley in Şanlıurfa Province of Turkey.

Fig. 1. Articifial overwintering shelter traps.

Material and Methods

This study was carried out to determine the overwintering spider fauna in pistachio orchards in Euphrates Valley in Birecik District of Şanlıurfa Province of Turkey in the winter seasons of 2017 and 2018 years. For this purpose, studies were conducted in five locations including Şehirbağı, Karabaş, Meyanca, Baraj, and Ekenek Villages. The main materials of the study were spiders, pistachio orchards, overwintering shelters including linen sack and corrugated cardboard used as wintering trap. In addition, mouth aspirator, 70% alcohol, eppendorf tubes, brushes of various thicknesses, transparent polyethylene bags, GPS, plastic jars and other laboratory materials were used. Artificial

overwintering shelter traps were established in five different pistachio orchards each of different village mentioned above. For this purpose, ten trees were selected within each orchard and five of these trees were wrapped with a burlap sack and five of them were wrapped with corrugated cardboard. The burlap sack and corrugated cardboard were wrapped around tree stems 20 cm above the ground and on tree trunks 40-50 cm wide to create overwintering habitats from September to the end of January (Fig. 1). The traps were fastened tightly around the tree trunks so as not to prevent spiders from entering. Spiders were collected from artificial shelters before leaving the overwintering period and the species were grouped according to taxonomy and recorded after counting. Then, these species were appropriately preserved, tagged and identified.

Table 1. Spider species collected from artificial winter shelter traps in the Euphrates Valley and their number by localities.

Family	**Species**	**Number/Location**				
		Meyanca	Karabaş	Baraj	Ekenek	Şehirbağı
Araneidae	*Hypsosinga pygmaea* (Sundevall, 1831)	**1**				
Clubionidae	*Clubiona* sp.	**2**				
Dictynidae	*Lathys ankaraensis* Özkütük, Marusik, Elverici & Kunt, 2016		**1**			
Gnaphosidae	*Micaria rossica* Thorell, 1875				**1**	
	Nomisia sp.		**2**			**2**
	Prodidomus redikorzevi Spassky, 1940		**2**			
	Synaphosus shirin Ovtsharenko, Levy & Platnick, 1994		**12**			**1**
Oecobiidae	*Oecobius maculatus* Simon, 1870		**4**			**1**
Palpimanidae	*Palpimanus gibbulus* Dufour, 1820		**1**			
Philodromidae	*Philodromus buxi* Simon, 1884				**2**	**1**
Salticidae	*Neon* sp.					**1**
	Pseudicius palaestinensis Strand, 1915		**3**			
	Thyene imperialis (Rossi, 1846)	**1**	**4**	**2**		**2**
Scytodidae	*Scytodes kinzelbachi* Wunderlich, 1995			**2**		**1**
Thomisidae	*Xysticus cristatus* (Clerck, 1757)		**3**			
Theridiidae	*Enoplognatha mandibularis* (Lucas, 1846)				**1**	
	Latrodectus tredecimguttatus (Rossi, 1790)		**1**			
	Neottiura bimaculata (Linnaeus, 1767)				**1**	
	Steatoda paykulliana (Walckenaer, 1806)		**1**			
	Theridion betteni Wiehle, 1960				**1**	
Total	**57 spiders**	**4**	**34**	**4**	**6**	**9**

Results

As a result of the study, 57 spiders of 20 species belonging to 20 genera and 11 families of order Araneae were determined in artificial overwintering shelters in pistachio orchards of the Euphrates Valley in Şanlıurfa Province of Turkey (Table 1). The species were determined according to the families as *Hypsosinga pygmaea* (Sundevall, 1831)

(Araneidae), *Clubiona* sp. (Clubionidae), *Lathys ankaraensis* Özkütük, Marusik, Elverici & Kunt, 2016 (Dictynidae), *Micaria rossica* Thorell, 1875, *Nomisia* sp., *Prodidomus redikorzevi* Spassky, 1940, and *Synaphosus shirin* Ovtsharenko, Levy & Platnick, 1994 (Gnaphosidae), *Oecobius maculatus* Simon, 1870 (Oecobiidae), *Palpimanus gibbulus* Dufour, 1820 (Palpimanidae), *Philodromus buxi* Simon, 1884 (Philodromidae), *Neon* sp., *Pseudicius palaestinensis* Strand, 1915, and *Thyene imperalis* (Rossi, 1846) (Salticidae), *Scytodes kinzelbachi* Wunderlich, 1995 (Scytodidae), *Xysticus cristatus* (Clerck, 1757) (Thomisidae), *Enoplognatha mandibularis* (Lucas, 1846), *Latrodectus tredecimguttatus* (Rossi, 1790), *Neottiura bimaculata* (Linnaeus, 1767), *Steatoda paykulliana* (Walckenaer, 1806), and *Theridion betteni* Wiehle, 1960 (Theridiidae) in artificial overwintering shelters in pistachio orchards of the Euphrates Valley in Şanlıurfa Province of Turkey (Table 1). As a result of the study, families Theridiidae, Gnaphosidae, and Salticidae were in the front in terms of species richness (Fig. 2).

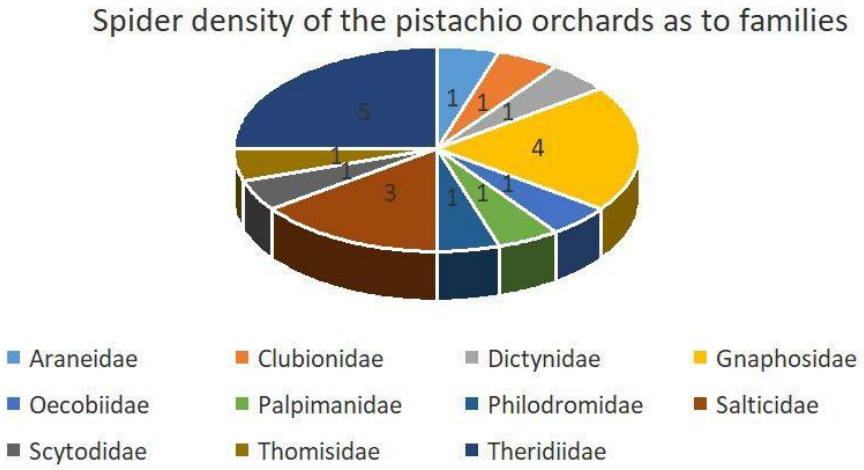

Fig. 2. Numbers of species according to families.

The numbers of individuals of each species catched by overwintering shelter traps are shown in Fig. (3).

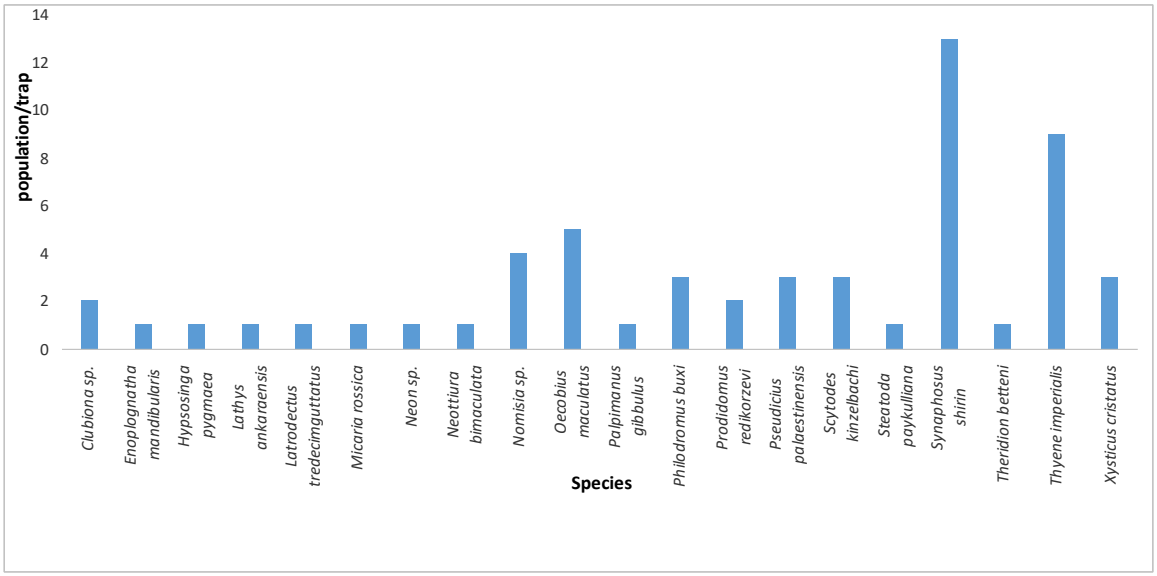

Fig. 3. Number of individuals of each species catched by overwintering shelter traps.

The largest number of species was recorded in Karabaş followed by Şehirbağı, then Ekenek. The lowest number of species was recorded in Meyanca and Baraj Villages (Fig. 4).

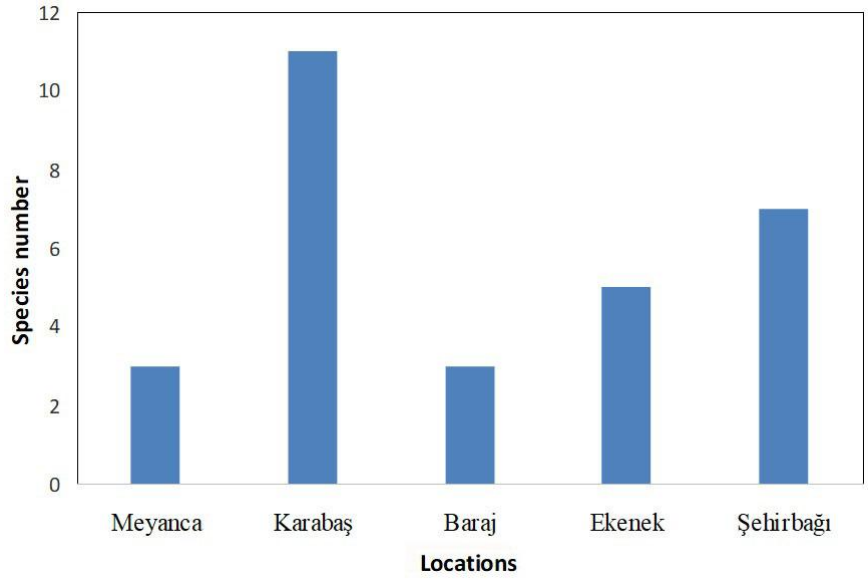

Fig. 4. Species number in overwintering traps by locations.

The largest number of spider individuals catched by overwintering shelter traps (34) was recorded in Karabaş too. The other four locations had small number of individuals (4-9) (Table 1, Fig. 5).

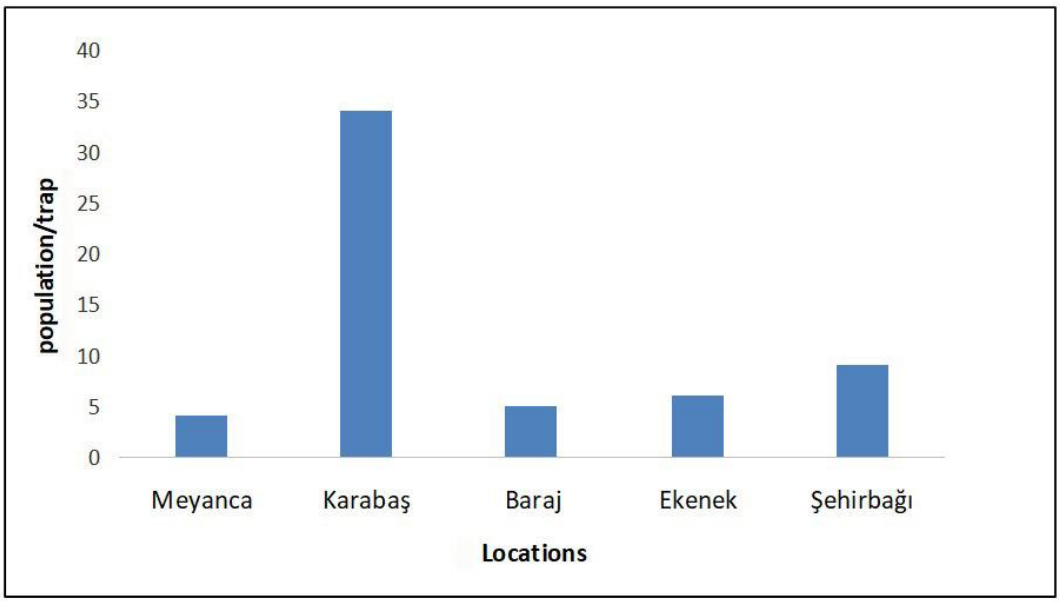

Fig. 5. Spider population in overwintering traps by locations.

Discussion

Abundant spider species in the arable fields over agricultural ecosystems are described as agrobiont spiders. Some tree shelters provide important microhabitats for agrobiont arachnids including specific microclimatic and structural conditions in the bark

cracks and hollows (Nikolai, 1986). Some spider species lives on tree trunks throughout the year, whereas other spiders use trees only for a certain period, mainly during overwintering (Horváth *et al.*, 2001). Pekár (1999) stated that bark-dwelling spiders act as pest control agents in orchards and reported that small pesticide tolerant spiders such as Theridiidae and Dictynidae were found in the commercial apple orchards, while larger susceptible spiders such as Clubionidae and Philodromidae were in the abandoned pear orchards. Similar results were also recorded in our study, relatively small spiders of pesticide tolerant Theridiidae, Dictynidae, Oecobiidae, and Araneidae were detected in pistachio orchards. Also in our study, *S. shirin* (Gnaphosidae) and *T. imperalis* (Salticidae) were found as most abundant species. The fact that the artificial winter shelter traps we use are close to the ground area and the species with high mobility can easily enter the traps reveal this result.

While spider families such as Araneidae, Tetragnathidae, Linyphiidae, and Theridiidae are more common in soybean, alfalfa, peanut, and rice fields, ambushers and stalkers such as Thomisidae, Philodromidae, Pisauridae, Salticidae, and Oxyopidae are often found in cotton, corn and sugar beet. (Uetz *et al.*, 1999). Also in our study similar results were determined. Spider abundance in fields varies also as to time, habitat, and collecting methods (Wissinger, 1997), because each spider species prefers different habitat, for instance, while pitfall and shelter traps collect mostly the ground zone spiders, sweeping nets collect the vegetation zone spiders.

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First record of *Phrurolithus thracia* Komnenov & Chatzaki, 2016 (Araneae: Phrurolithidae) from Turkey

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Abstract

Phrurolithus thracia Komnenov & Chatzaki, 2016 is recorded from Turkey for the first time. Its characteristic features and photographs are presented. With this record the number of species belonging to genus *Phrurolithus* increased to 3 in Turkey.

Keywords: Araneae, Phrurolithidae, *Phrurolithus thracia*, new record, Turkey.

Introduction

Phrurolithidae is a family of small araneomorph spiders first described by Banks (1892). Family Phrurolithidae was formerly included in the Corinnidae and Liocranidae as subfamily Phrurolithinae. This family includes 247 species in 15 genera over the world. *Phrurolithus* C.L. Koch, 1839 is the second largest genus (56 species) in the family after *Otacilia* Thorell, 1897 (113 species) (World Spider Catalog, 2020). Currently, 14 species belonging to 4 genera are known from Europe (Nentwig *et al.*, 2020). The known phrurolithid fauna of Turkey includes 2 species of genus *Phrurolithus*. These species are: *P. festivus* (C.L. Koch, 1835) and *P. pullatus* Kulczyński, 1897 (Danışman *et al.*, 2017; Danışman *et al.*, 2019). The goal of this short paper is to provide new data about the *Phrurolithus* of Turkey.

Material and Methods

Specimens were collected from Balıkesir province by hand picking. Digital images were taken using a Leica S8APO microscope by means of the Canon EOS 250D

camera. Images have been montaged using 'Combine ZM' image stacking software and 'Photoshop CC2019'image editing software. Spiders were deposited in the collection of the Arachnological Museum of Kırıkkale University (KUAM). All measurements are expressed in millimetres. Leg measurements are shown as: total length (femur, patella, tibia, metatarsus, tarsus).

Results

Family **Phrurolithidae** Banks, 1892
Genus ***Phrurolithus*** C.L. Koch, 1839

Phrurolithus thracia Komnenov & Chatzaki, 2016
[in Komnenov *et al.*, 2016: 38, f. 85-96 (D♂♀)]

Material examined: 2♂♂, Edremit, Balıkesir, 39°36'37.2"N 27°00'35.2"E. 28.06.2015. from pine forest. alt. 530 m. Leg. T. Danışman.

Distribution: Greece (World Spider Catalog, 2020).

Male description: Total length 4.85. Prosoma 2.35 long, 1.85 wide. Abdomen 2.5 long, 1.7 wide. Ocular area long 0.60. Palp long 1.50. Sternum 1.30 long, 1.10 wide.
Legs: I. 2.70 (0.80, 0.20, 0.70, 0.60, 0.40), II. 2.10 (0.60, 0.20, 0.50, 0.50, 0.30), III. 1.95 (0.55, 0.20, 0.45, 0.45, 0.30), IV. 3.0 (0.85, 0.20, 0.75, 0.70, 0.50). Leg formula IV-I-II-III. Prosoma light brown with gray pattern (Fig. 1-A). Clypeus brown, narrow and covered with a few dark colour hairs. Chelicerae dark brown and bright colour haired dorsally (Figs. 1-C and 1-D). Sternum yellowish brown and intensely covered with short black hairs. Labium and maxillae light brown (Fig. 1-B). Patella, tibia, metatarsus, and tarsus segments of the legs are yellowish brown, only femur is darker in colour. Abdomen is pale black and intensely covered with hairs (Fig. 1-A). Spinnerets light yellow (Fig. 1-B).

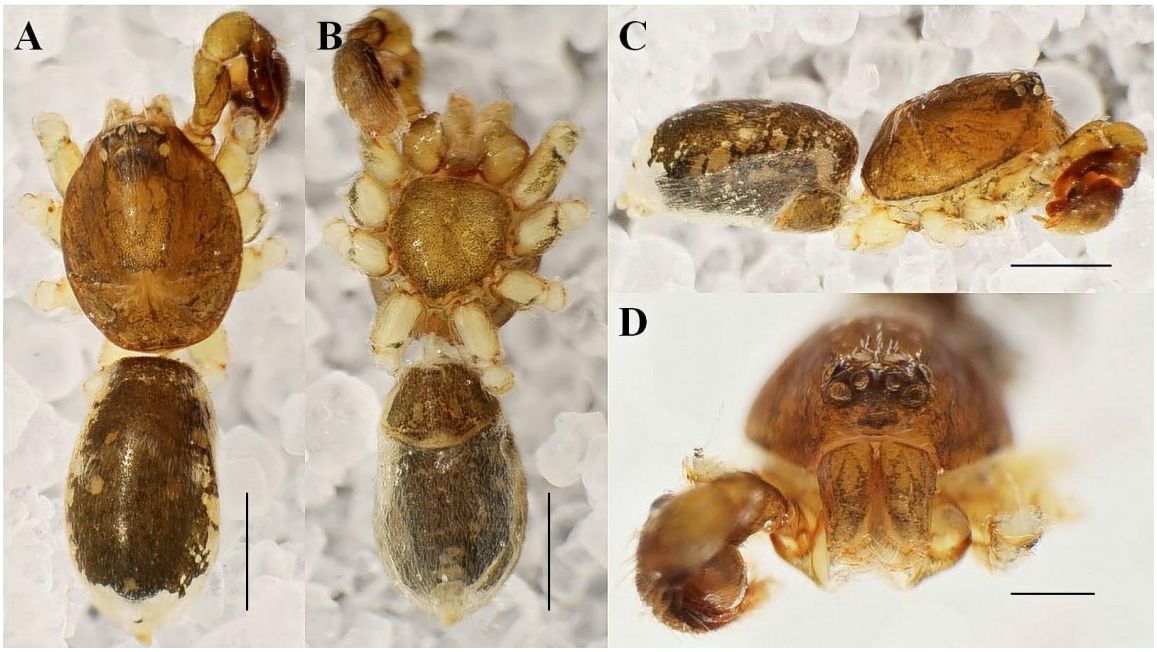

Fig. 1. *Phrurolithus thracia* Komnenov & Chatzaki, 2016 ♂, habitus. A. dorsal view. B. ventral view. C. lateral view. D. ocular area, frontal view.
(Scales: Figs. A-C 0.5 mm, Fig. D 0.2 mm)

Pedipalp: tibial apophysis is broad, tapering only at the tip, its tip is asymmetrical (Figs. 2A and 2C). Distal bulbal apophysis long, easily visible from the lateral position (Figs. 2A-C).

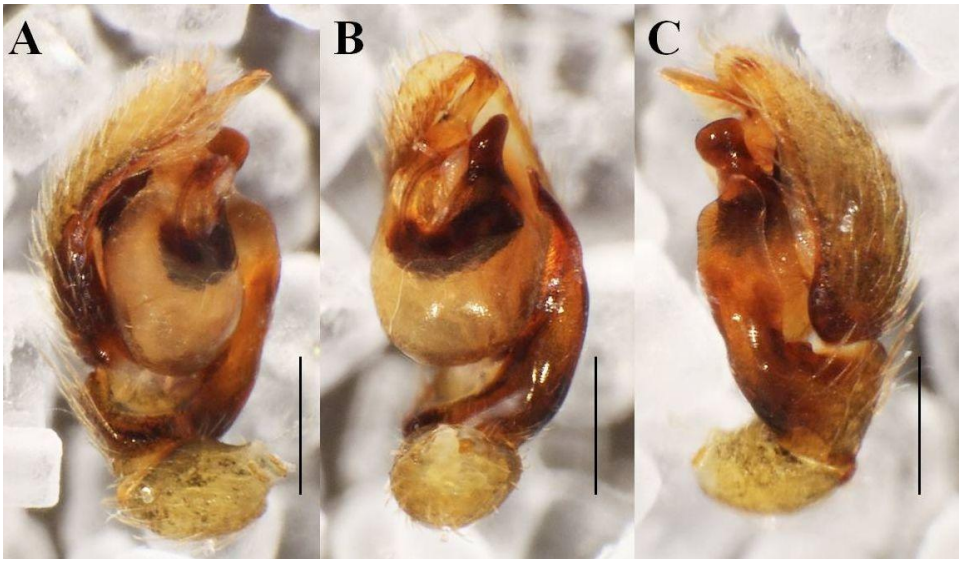

Fig. 2. *Phrurolithus thracia* Komnenov & Chatzaki, 2016 ♂, pedipalp. A. prolateral view. B. ventral view. C. retrolateral view. (Scale: 0.2 mm)

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Faunal diversity of Hahniidae, Hersiliidae and Homalonychidae (Arachnida: Araneae: Araneomorphae) in India

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Abstract

The present article deals with the faunal diversity of three families of araeneomorph spiders, viz. Hahniidae, Hersiliidae and Homalonychidae (Arachnida: Araneae) in different Indian states and union territories. None of the spider species of these families is recorded from Arunchal Pradesh, Himachal Pradesh, Ladakh, Mizoram, and Nagaland. Among these, the largest family is Hersiliidae which is represented by 14 species in 3 genera. Other families are very poorly represented in India. A single species in Homalonychidae and 5 species in Hahniidae are recorded. Only one species, *Hersilia savignyi* Lucas, 1836 is distributed almost throughout the country except Jammu & Kashmir, Ladakh and Himachal Pradesh in north, and Arunachal Pradesh, Mizoram, Nagaland, Sikkim and Tripura in northeast. Maximum number of spider species of these families were recorded in Kerala (9 species) followed by Tamil Nadu (7 species), Gujarat (6 species), Andhra Pradesh and West Bengal (5 species each), and Karnataka, Maharashtra and Uttar Pradesh (4 species each) and less number in other states and union territories. Out of 19 species recorded of these 3 families, 11 species are endemic and 2 species seem to be erroneous records.

Keywords: Spiders, Hahniidae, Hersiliidae, Homalonychidae, Faunal Diversity, India.

Introduction

Spiders (Arachnida: Araneae) have a very significant role to play in the ecology by being exclusively predatory and thereby regulate insect populations. All spiders are venomous but venom of only few species is harmful to humans, though its venom is useful in the study of neuromuscular and cardiac pharmacology. Spiders perform ecological services by predating harmful insects of crops and maintain their population below economic injury level. Despite the applied values, the spiders have received very little attention as far as their conservation is concerned. Only few tarantulas in India are listed in IUCN Red List (Molur *et al.*, 2008) and Siliwal *et al.* (2011) recommended immediate action to conserve them to prevent their extinction. In spite of current researches on diversity and distribution of spiders in India, their number is meagre as compared to other regions of the world. Out of 48,907 described species under 4,188 genera and 128 families in the world (World Spider Catalog, 2020), only 1854 species belonging to 470 genera in 61 families are known in India (Caleb & Sankaran, 2020). Recently, Singh & Singh (2020) and Singh *et al.* (2020a,b,c,d,e) updated the distribution pattern of certain families of spiders.

The present article deals with the faunal distribution of only three families of Araneomorphae spiders, Hahniidae, Hersiliidae, and Homalonychidae in different Indian states and union territories. The amount of knowledge of these families is very little and underrepresented in India and the available literature are also scattered and so far no consolidated account is available regarding their distribution pattern across the country. Therefore, this present work was taken up to provide up-to-date information of these families in the light of modern taxonomic concept. Several species reported and described from India appear to be misidentified and the records are reported erroneously as these species are said to be identified by using existing literature without a re-examination of the corresponding types and without consulting any spider taxonomist of the country (Singh & Singh, 2020). Hence, such reports need re-examination. Also, in most of the literature, published earlier, several errors crept in their scientific names even in the recent ones because such contents become outdated quickly and, due to their perceived comprehensiveness, readers sometimes overlook newer sources of data. In addition, researches are continuous on the spider taxonomy with the description of new taxa, their modified status, and the publication of other nomenclatural decisions (Singh *et al.*, 2020a).

Material and Methods

This checklist is prepared on the basis of published literature in surveys, books, journals, theses and World Spider Catalog up to 8 November, 2020. In the present checklist, attempts have been made to correct such errors in the scientific names of the spiders. Only those synonymies were referred that were reported in India. For other synonymies, World Spider Catalog (2020) may be consulted. All the endemic species are marked with (*). Seemingly erroneous records are marked with (♠). If the spider species is not endemic, its elsewhere distribution is also provided.

Results and Discussion

A. Faunal Diversity of the Family Hahniidae Bertkau, 1878

Hahniidae is a fairly small family of spiders, commonly called as Comb-Tailed spiders. The family is represented with 351 species in 23 genera globally and widely distributed. They are small, 1.5 to 6.0 mm long, and can be diagnosed by observing the arrangement of their six spinnerets in a transverse row, being last segment of the outer spinnerets quite long and visible. In addition, they have 8 eyes arranged in two rows of 4 each and 3 tarsal claws (Murphy & Murphy, 2000). These spiders construct extremely fragile webs made by almost invisible silk in the form of a sheet without leading to a retreat nearby leaf litter and detritus close to the ground or on the leaves of shrubs and trees. They usually hunt the prey on the upper side of the web sheet.

In India, it is represented with only 5 species in 3 genera out of which 4 species are endemic. One species *Hahnia yakouensis* Chen, Yan & Yin, 2009, reported from Kerala, seems to be misidentified. Another species, *Hahnia alini* Tikader, 1964 is only known from Nepal, but erroneously mentioned to occur in Western Ghat by Sudhikumar *et al.* (2008) and Sebastian *et al.* (2012). Following is the detail list of these spiders distributed in Indian states and union territories and elsewhere.

1. *Hahnia mridulae* Tikader, 1970 *
- Kerala (Joseph *et al.*, 2017)
- Sikkim (Tikader, 1970)
- Uttar Pradesh (Hore & Uniyal, 2008)

2. *Hahnia yakouensis* Chen, Yan & Yin, 2009 (♠)
- Kerala (Asalatha *et al.*, 2017)

Elsewhere: China.

3. *Hahnia* sp.
- Uttar Pradesh (Hore & Uniyal, 2008)
- Uttarakhand (Uniyal *et al.*, 2011)

4. *Neoantistea caporiaccoi* Brignoli, 1976 *
- Jammu & Kashmir (Brignoli, 1976)

5. *Neoantistea maxima* (Caporiacco, 1935) *

=*Hahnia maxima* Caporiacco, 1935
- Jammu & Kashmir (Caporiacco, 1935)
- Uttar Pradesh (Hore & Uniyal, 2008)

6. *Scotospilus maindroni* (Simon, 1906)*

=*Hahnia maindroni* Simon, 1906
- Gujarat (Parasharya & Pathan, 2013)
- Kerala (Joseph *et al.*, 2017)
- Tamil Nadu (Simon, 1906; Karthikeyani *et al.*, 2017; Caleb & Karthikeyani, 2020)

B. Faunal Diversity of the Family Hersiliidae Thorell, 1870

Hersiliidae is a small family of tropical and subtropical spiders, commonly known as Long-Spinnered or Two-Tailed spiders. It consists of only 182 species in 16 genera (World Spider Catalog, 2020). These spiders are characterized by having two long and

prominent spinnerets at the tip of the abdomen looking like tail. They are 10-15 mm long, dorso-ventrally flattened and have eight eyes, arranged in two recurved rows on a raised hump or tubercle. They do not spin web, rather than lay a light coating of threads over an area of tree bark and wait for a prey onto the patch. On the arrival of prey, they enclose their spinnerets around it while releasing silk on it.

In India, it is represented with only 14 species in 3 genera out of which 7 species are endemic. Two species *Hersilia deelemanae* Baehr & Baehr, 1993 and *Hersilia pectinata* Thorell, 1895, reported from Gujarat, and Kerala and Tamil Nadu, respectively, seem to be misidentified. Following is the detail list of these spiders distributed in Indian states and union territories and elsewhere.

1. *Hersilia deelemanae* Baehr & Baehr, 1993 (♠)
- Gujarat (Thumar, 2019)

Elsewhere: Indonesia.

2. *Hersilia longivulva* Sen, Saha & Raychaudhuri, 2010 *
- Maharashtra (Rithe, 2012)
- West Bengal (Sen *et al.*, 2010, 2015)

3. *Hersilia orvakalensis* Javed, Foord & Tampal, 2010 *
- Andhra Pradesh (Javed *et al.*, 2010)
- Haryana (Malik & Goyal, 2017; Goyal & Malik, 2018)
- Maharashtra (Rithe, 2012)
- Telangana (Pravalikha *et al.*, 2013)

4. *Hersilia pectinata* Thorell, 1895 (♠)
- Kerala (Joseph *et al.*, 1998)
- Tamil Nadu (Sugumaran, 2001)

Elsewhere: Indonesia, Myanmar, Philippines.

5. *Hersilia savignyi* Lucas, 1836
=*Hersilia indica* Walckenaer, 1837
=*Hersilia calcuttensis* Stoliczka, 1869
=*Hersilia clathrata* Thorell, 1895
=*Hersilia aadi* Pravalikha *et al.*, 2014
- Andaman (Tikader, 1977; Majumder, 2004; Sebastian *et al.*, 2012)
- Andhra Pradesh (Pravalikha *et al.*, 2014; Palem *et al.*, 2016)
- Assam (Tikader, 1977; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Baehr & Baehr, 1993; Singh *et al.*, 2013)
- Bihar (Gajbe, 2007)
- Chhattisgarh (Gajbe, 2003; Gajbe, 2007; Gajbe & Sharma, 1994; Kujur & Ekka, 2016)
- Delhi (Malik *et al.*, 2015)
- Goa (Bastawade & Borkar, 2008; Pandit & Pai, 2017; Pandit & Dharwadkar, 2020)
- Gujarat (Patel & Vyas, 2001; Siliwal *et al.*, 2003; Patel, 2003b; Yadav *et al.*, 2017)
- Haryana (Malik & Goyal, 2017)
- Jharkhand (Agrawal & Ghose, 1995b; Gajbe, 2007)
- Karnataka (Simon, 1885; Sherriffs, 1927; Gajbe, 2007; Caleb *et al.*, 2017)
- Kerala (Tikader, 1977; Baehr & Baehr, 1993; Patel, 2003a; Sebastian *et al.*, 2005; Jose *et al.*, 2018)

- Lakshadweep (Pocock, 1904)
- Madhya Pradesh (Gajbe, 1992, 2007; Gajbe, 2003; Patil, 2012)
- Maharashtra (Pocock, 1900; Tikader, 1977; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Majumder, 2004; Bastawade & Khandal, 2006)
- Manipur (Kananbala *et al.*, 2018)
- Meghalaya (Bhattacharya *et al.*, 2017)
- Odisha (Gravely, 1921; Biswas, 1987; Ramakrishna *et al.*, 2006; Gajbe, 2007; De & Palita, 2018)
- Puducherry (Leardi in Airaghi, 1901; Simon, 1905)
- Punjab (Kumari, 1983)
- Rajasthan (Chauhan *et al.*, 2009; Saini *et al.*, 2012; Kaur *et al.*, 2014; Jangid *et al.*, 2019)
- Tamil Nadu (Pocock, 1900; Sherriffs, 1919; Tikader, 1977; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Baehr & Baehr, 1993; Majumder, 2004; Caleb *et al.*, 2017; Caleb, 2020b)
- Telangana (Rao *et al.*, 2005; Pravalikha *et al.*, 2014; Sailu *et al.*, 2017)
- Uttar Pradesh (Pocock, 1900; Tikader, 1977; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Majumder, 2004; Uniyal & Hore, 2009; Sharma & Singh, 2018a, b)
- Uttarakhand (Gajbe, 2007; Biswas & Biswas, 2010; Gupta & Siliwal, 2012; Anilkumar *et al.*, 2019)
- West Bengal (Stoliczka, 1869; Pocock, 1900; Tikader, 1977; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Baehr & Baehr, 1993; Majumder, 2004; Majumder & Talukdar, 2013; Raychaudhuri *et al.*, 2016)

Elsewhere: Bangladesh, Myanmar, New Guinea, Philippines.

6. *Hersilia scrupulosa* Foord & Dippenaar-Schoeman, 2006
- Karnataka (Talwar *et al.*, 2019)

Elsewhere: Kenya.

7. *Hersilia striata* Wang & Yin, 1985
- Gujarat (Parmar, 2018)
- Kerala (Rajeevan *et al.*, 2019)
- West Bengal (Sen *et al.*, 2010, 2015)

Elsewhere: China, Indonesia, Myanmar, Taiwan, Thailand.

8. *Hersilia sumatrana* (Thorell, 1890)
=*Hersilia stevensi* Sinha, 1951
- Gujarat (Thumar, 2019)
- Karnataka (Mubeen & Basavarajappa, 2018)
- Kerala (Joseph *et al.*, 2017)
- West Bengal (Sinha, 1951; Baehr & Baehr, 1993; Agrawal & Ghose, 1995a; Majumder & Talukdar, 2013)

Elsewhere: Indonesia, Malaysia.

9. *Hersilia tibialis* Baehr & Baehr, 1993
=*Hersilia pectinata* Thorell, 1895**,** misidentified (Sinha, 1951)
- Kerala (Baehr & Baehr, 1993; Caleb, 2020b)
- Maharashtra (Sinha, 1951; More, 2015; Deshmukh & Tekade, 2019)
- Tamil Nadu (Baehr & Baehr, 1993; Caleb & Karthikeyani, 2020; Caleb, 2020a, b)

Elsewhere: Sri Lanka.

10. ***Hersilia*** sp.
- Bihar (Priyadarshini *et al.*, 2015)
- Gujarat (Parmar *et al.*, 2015)
- Karnataka (Prashanthakumara *et al.*, 2015; Kokilamani *et al.*, 2019)
- Kerala (Patel, 2003a; Sudhikumar *et al.*, 2005)
- Maharashtra (Meshram, 2011; Lanka *et al.*, 2017)
- Tamil Nadu (Sugumaran *et al.*, 2007)
- Tripura (Dey *et al.*, 2013)
- Uttar Pradesh (Prakash & Prakash, 2012)
- Uttarakhand (Uniyal *et al.*, 2011; Anilkumar *et al.*, 2019)

11. ***Murricia hyderabadensis*** Javed & Tampal, 2010 *
- Andhra Pradesh (Javed & Tampal, 2010)
- Gujarat (Yadav *et al.*, 2017; Solanki *et al.*, 2020)

12. ***Murricia trapezodica*** Sen, Saha & Raychaudhuri, 2010 *
- West Bengal (Sen *et al.*, 2010, 2015)

13. ***Murricia triangularis*** Baehr & Baehr, 1993 *
- Andhra Pradesh (Javed & Tampal, 2010)
- Kerala (Rajeevan *et al.*, 2019)
- Tamil Nadu (Baehr & Baehr, 1993)

14. ***Murricia*** sp.
- Karnataka (Abhijith, 2019)
- Telangana (Sailu *et al.*, 2017)

15. ***Neotama punctigera*** Baehr & Baehr, 1993 *
- Tamil Nadu (Baehr & Baehr, 1993)
- Uttar Pradesh (Uniyal & Hore, 2009)

16. ***Neotama rothorum*** Baehr & Baehr, 1993 *
- Tamil Nadu (Baehr & Baehr, 1993)

C. Faunal Diversity of the Family Homalonychidae Simon, 1893

Homalonychidae is a very small family of spiders. These spiders do not build webs, and are typically found under rocks or dead vegetation. The American species live in deserts, to which they are adapted by colour and specialized setae which allow them to attach sand and fine soil to themselves. It contains only 3 species in a single type genus. Two species were described in the southern United States and Mexico while the single species *Homalonychus raghavai* Patel & Reddy, 1991 was described from India which is supposed to be misplaced in this genus (World Spider Catalog, 2020).

1. ***Homalonychus raghavai*** Patel & Reddy, 1991 *
- Andhra Pradesh (Patel & Reddy, 1991)

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Diversity and population fluctuation of jumping spiders (Araneae: Salticidae) of Calicut University campus, Kerala, India

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Abstract

Salticidae, also known as jumping spiders, is the largest spider family. They are strongly influenced by habitat type. Here we describe the diversity and seasonal variation of jumping spider fauna of Calicut University campus, which spread over 500 acres. This study was conducted for ten months and spiders were collected by hand picking method and beating method. A total of 46 species of jumping spiders coming under 33 genera were collected. A taxonomically complete inventory of species, with good taxonomic resolution, is an advantageous feature that can be used in the analysis of species diversity and has great potential in setting conservation priorities, and support for environmental monitoring. Besides, this taxonomic information can be used to measure β-diversity, based on taxonomic dissimilarity coefficients for presence/absence data, regardless of the sampling effort. In this way, checklist or faunistic studies demonstrate a clear connection between basic taxonomy and biodiversity issues; and, as in other fields, these inventories provide an important source of quantitative compiled information concerning species diversity of several regions.

Keywords: Checklist, Jumping spider, Faunistic inventory, Seasonal variation, Biodiversity conservation, India.

Introduction

Biodiversity is often used as a measure of the health of biological systems. Spiders clearly have an integral part of global biodiversity as an important indicator in biodiversity assessment studies. Spiders form an especially diverse and ecologically important group which ecological dominance has been the subject of intense study. Despite this long history of research and their ecological importance, considerable gaps remain in our understanding of spider fauna of Kerala. A more complete inventory of spiders is essential to advance understanding of their ecology, evolution, and behaviour, and to take full advantage of their demonstrated value in conservation priority setting, bio-monitoring, and biological control (Magurran, 2004; Myers *et al.*, 2000). Spiders are obligate carnivores and hold the unique position of being the only large class of arthropods which are entirely predatory in nature. Predation significantly contributes towards preventing the excessive increase of insect populations. Under normal field conditions, if one predator species is absent, another one may take its place. An increase in the population of spiders significantly contributed to prey limitation (Provencher & Riechert, 1994). However, if there has been a widespread and continued catastrophe, such as drought or misuse of insecticides, this is no longer possible, and the reproduction of insect and pest species may continue unabated until starvation or disease intervenes.

Obviously, all these arachnological characteristics have led field ecologists to consider the spiders as a potentially excellent group for limiting pests and acting as bioindicators. Spiders generally have humidity and temperature preferences that limit them to areas within the range of their physiological tolerances, which in turn makes them ideal candidates for land conservation studies (Noss, 1990). Therefore, documenting spider diversity patterns can provide important information on the biodiversity of this tropical forest ecosystem. It is expected that the study will expose the original diversity of spider fauna and bring this otherwise neglected animal group onto the conservation radar screen. Since spiders as a group may even provide useful conservation tools as ecological indicators in rapid biodiversity measurement, there is an urgent need to provide taxonomic resources for groups from tropical ecosystems in the view of current global biodiversity crisis (Rosenzweig, 1995). In this study, the first quantitative survey of jumping spider in the Calicut University campus was conducted with an aim to study the diversity and seasonal fluctuation in salticid spider abundance.

Salticidae is the largest spider family in the world grouping 646 genera and 6,231 species (World Spider Catalog, 2020) and they are commonly called jumping spiders because most of the species are very active in warm weather, leaping from leaves, bark, twigs in the search of prey or to escape from potential predators. They are very small to medium-sized, active, hunting spiders capable of jumping or leaping to a distance. The most characteristic feature is the ocular clad on the cephalothorax delimited by eight eyes arranged in three or four rows. Front row formed of forwardly directed four eyes among which the anterior median eyes are very large and easily noticeable. They move by walking, running, jumping or leaping and use all these movements for prey capture. They hunt the prey by stalking, chasing and leaping over it. Prey mainly includes insects; some also prefer other spiders or ants. They are characterized by an acute visual system and being capable of very agile jumps. Generally, they are day hunters that actively seek their prey. Jumping spiders are strongly influenced by habitat type. Their abundance and species composition are affected by the structural complexity of vegetation, giving their

site preferences for stalking and hunting prey. The combination of narrow spatial niches occupied by most species and diverse microhabitats within a site would explain the high diversity of jumping spiders. Also, jumping spiders are easily located due to their conspicuousness and high abundance in ecosystems. These features lead to consider this group as an appropriate model for biodiversity studies. Here we describe the diversity and seasonal variation of jumping spider fauna of Calicut University campus. In this way, checklist or faunistic studies demonstrate a clear connection between basic taxonomy and biodiversity issues; and, as in other fields, these inventories provide an important source of quantitative compiled information concerning species diversity of several regions.

Material and Methods

Calicut University campus was selected for the study. It is situated at 11.1340°N, 75.8952°E in the Malappuram district of Kerala. This area enjoys a humid tropical climate. The normal annual rainfall is 2469 mm. The mean maximum and minimum temperatures are 30.8ºC and 25.3ºC, respectively. The mean relative humidity is 86.7%. This campus is spread across 500 acres of land with mixed type plantation, agricultural lands, and open grass lands. The ample rainfall and balanced tropical climate facilitates luxuriant plant growth in this area.

The investigation was carried out for a period of 10 months from June 2019 to March 2020; which included monsoon and post-monsoon seasons. Spiders were collected twice in a month in sessions starting in the evening (4.00 pm) up to late evening (7.00 pm). An all-out search method was used for collecting the spiders. For a systematic collection, the entire place was divided into six areas, and the plants were thoroughly examined for the possible spiders. Collection was conducted mainly by hand picking and beating method. Aerial sampling of spiders was done by searching leaves, branches, tree trunks, and spaces in between, from knee height up to maximum overhead arm's reach and transferring them into collecting bottles. Spiders from height above were mainly collected by beating method in which vegetation was shaken with hands or beaten with a one meter long stick and catching the falling spiders on an inverted umbrella held below and transferring them to collecting bottles. Ground dwelling spiders were searched exploring leaf litter, under surface of logs, rocks, and plant surfaces below the knee. Comparatively large specimens were photographed in the field itself before collection with the help of special digital camera and lens (Canon EOS 5D digital SLR and Canon 180 mm macro lens). Specimens were preserved in 75% alcohol with proper labelling of locality, date, and other notes of importance for further studies. Genitalia of all adult specimens were examined under a stereo zoom binocular microscope (Leica-M205C) for species level identification. Spiders were identified up to species level with the help of available literature (Metzner, 2019; Prószyński, 2020; Sebastian & Peter, 2009; World Spider Catalog, 2020). The collected data was used to study seasonal variation in salticid population.

Results

A total of 46 species of jumping spiders coming under 33 genera were collected during the period of study (Table 1). The collected salticids come under the category of foliage jumpers, ground jumpers, litter dwellers and bark dwellers. *Telamonia dimidiata*

(two striped jumper) was the most dominant species followed by *Hyllus semicupreus* (tufted jumper), *Hasarius adansoni* (crescent jumper), *Myrmaplata plataleoides* (red ant-mimicking jumper), and *Menemerus bivittatus* (bark jumper). General population study showed that the population of jumping spiders in the Calicut University campus gradually increased from monsoon season (June-October) to post-monsoon season (November-March) (Fig. 1). In the month of June, a total of 52 individuals of jumping spiders were collected and it was 68 in the month of March. The abundance was 47, 46, 60, 54, 59, 66, 75 and 79 respectively in July, August, September, October, November, December, January and February. Population fluctuation of the above 5 dominant species studied in detail. This study revealed that population of foliage dwelling salticids (*T. dimidiata*, *H. semicupreus* and *M. plataleoides*) increased from monsoon season to post-monsoon season. While population of litter dwelling (*H. adansoni*) and bark dwelling (*M. bivittatus*) jumping spiders decreased from monsoon season to post monsoon season (Fig. 2).

Table 1. List of jumping spiders collected from Calicut University campus with abundance numbers.

Sl. No.	Species	Month									
		June	July	August	September	October	November	December	January	February	March
1	*Asemonea tenuipes* (O. Pickard-Cambridge, 1869)	0	3	1	2	2	1	3	2	4	4
2	*Bianor angulosus* (Karsch, 1879)	1	2	1	0	1	1	2	1	1	1
3	*Brancus calebi* Kanesharatnam & Benjamin, 2018	0	0	1	0	0	0	0	0	0	0
4	*Brettus cingulatus* Thorell, 1895	0	0	1	0	1	0	0	2	0	1
5	*Burmattus pococki* (Thorell, 1895)	0	0	0	0	0	0	2	0	2	0
6	*Carrhotus viduus* (C.L. Koch, 1846)	2	1	2	3	4	4	5	5	3	2
7	*Chalcotropis pennata* Simon, 1902	1	1	2	2	1	3	1	1	0	1
8	*Chrysilla volupe* (Karsch, 1879)	0	0	0	1	0	0	1	0	0	0
9	*Cocalus lacinia* Sudhin, Nafin, Sumesh & Sudhikumar, 2019	0	0	0	1	0	0	0	0	1	0
10	*Epeus tener* (Simon, 1877)	2	0	1	2	1	2	3	2	1	1
11	*Epeus triangulopalpis* Malamel, Nafin, Sudhikumar & Sebastian, 2019	1	1	1	1	0	0	0	1	1	0
12	*Epocilla aurantiaca* (Simon, 1885)	0	0	0	0	0	0	0	1	1	0
13	*Evarcha flavocincta* (C.L. Koch, 1846)	0	0	0	1	0	0	0	0	1	0
14	*Harmochirus zabkai* Logunov, 2001	1	1	0	0	0	0	0	0	0	0
15	*Hasarius adansoni* (Audouin, 1825)	7	6	5	5	4	3	3	2	3	3
16	*Hyllus manu* Caleb, Christudhas, Laltanpuii & Chitra, 2014	0	0	0	0	0	0	0	0	1	1
17	*Hyllus semicupreus* (Simon, 1885)	2	2	4	6	5	6	6	7	7	6
18	*Indopadilla insularis* (Malamel, Sankaran & Sebastian, 2015)	3	4	2	2	4	4	2	3	5	2
19	*Marengo batheryensis* Sudhin, Nafin, Benjamin & Sudhikumar, 2019	0	0	0	0	0	0	0	0	1	0
20	*Marengo crassipes* Peckham & Peckham, 1892	0	0	0	0	0	0	0	0	1	0

21	*Marengo zebra* Sudhin, Nafin, Benjamin & Sudhikumar, 2019	0	0	0	0	0	0	0	0	0	1
22	*Menemerus bivittatus* (Dufour, 1831)	4	5	4	4	4	2	3	3	2	2
23	*Menemerus fulvus* (L. Koch, 1878)	2	1	1	4	2	0	0	1	1	2
24	*Myrmaplata plataleoides* (O. Pickard-Cambridge, 1869)	2	1	3	4	5	7	7	8	7	8
25	*Myrmarachne melanocephala* MacLeay, 1839	1	0	2	1	0	3	2	3	2	1
26	*Phaeacius lancearius* (Thorell, 1895)	1	0	0	0	0	0	1	0	0	0
27	*Phidippus yashodharae* Tikader, 1977	0	0	0	0	0	0	0	0	1	1
28	*Phintella debilis* (Thorell, 1891)	0	0	0	0	0	0	0	0	1	0
29	*Phintella vittata* (C.L. Koch, 1846)	3	4	4	5	2	3	4	2	2	0
30	*Phintelloides jesudasi* (Caleb & Mathai, 2014)	0	0	1	0	0	1	2	2	4	4
31	*Piranthus planolancis* Malamel, Nafin, Sudhikumar & Sebastian, 2019	0	0	0	0	0	0	2	0	0	1
32	*Plexippus paykulli* (Audouin, 1825)	3	4	2	2	4	3	3	2	1	3
33	*Plexippus petersi* (Karsch, 1878)	2	2	1	3	3	2	1	3	2	2
34	*Portia fimbriata* (Doleschall, 1859)	0	0	0	0	0	0	0	1	0	2
35	*Rhene danieli* Tikader, 1973	1	1	0	0	0	0	0	0	0	2
36	*Rhene flavigera* (C.L. Koch, 1846)	0	0	0	0	0	0	0	1	0	0
37	*Rhene rubrigera* (Thorell, 1887)	0	0	0	0	0	0	0	1	2	0
38	*Siler semiglaucus* (Simon, 1901)	1	0	0	0	0	1	0	2	0	1
39	*Stenaelurillus albus* Sebastian, Sankaran, Malamel & Joseph, 2015	2	1	0	0	0	0	0	1	1	1
40	*Stenaelurillus arambagensis* (Biswas & Biswas, 1992)	2	1	0	0	0	0	0	0	2	2
41	*Stenaelurillus gabrieli* Prajapati, Murthappa, Sankaran & Sebastian, 2016	2	0	0	0	0	0	1	2	1	2
42	*Stenaelurillus lesserti* Reimoser, 1934	0	0	0	0	0	0	0	1	1	0
43	*Tamigalesus munnaricus* Żabka, 1988	2	2	3	2	3	3	4	4	3	3
44	*Telamonia dimidiata* (Simon, 1899)	2	3	3	6	7	8	5	4	4	3
45	*Telamonia festiva* Thorell, 1887	0	0	0	0	0	0	0	1	2	0
46	*Thiania bhamoensis* Thorell, 1887	2	1	1	3	1	2	1	3	4	1

Discussion

Calicut University campus is a lush patch of land situated in Malappuram district of Kerala. The results revealed many interesting facts. The presence of 46 species in 33 genera of jumping spiders clearly indicates a high diversity of jumping spiders distributed in the study area. Hawksworth & Kalin-Arryo (1995) suggested that diversity generally increases when a greater variety of habitat types were present. The study area is endowed with different types of habitats such as grassland, different types of plantation crops and shrubs. This may be the reason for the species richness. Riechert & Lockley (1984) also noted this trend among spider populations. According to them, spider diversity and density are directly related to the structural complexity of the environment. Highly varied habitats provide a greater array of microhabitats, microclimatic features, alternative food sources and retreat sites, all of which encourage colonization and establishment of spiders. Many other studies also have demonstrated a correlation existed between the structural complexity of habitat and species diversity (Andow, 1991). In 1991, Uetz reported that structurally a more complex shrub can support a more diverse spider community (Uetz, 1991). The study area was gifted with a plenty of shrub jungle. Studies

have also shown that jumping spiders respond to depth and complexity of the vegetation (Bishop & Riechert, 1990).

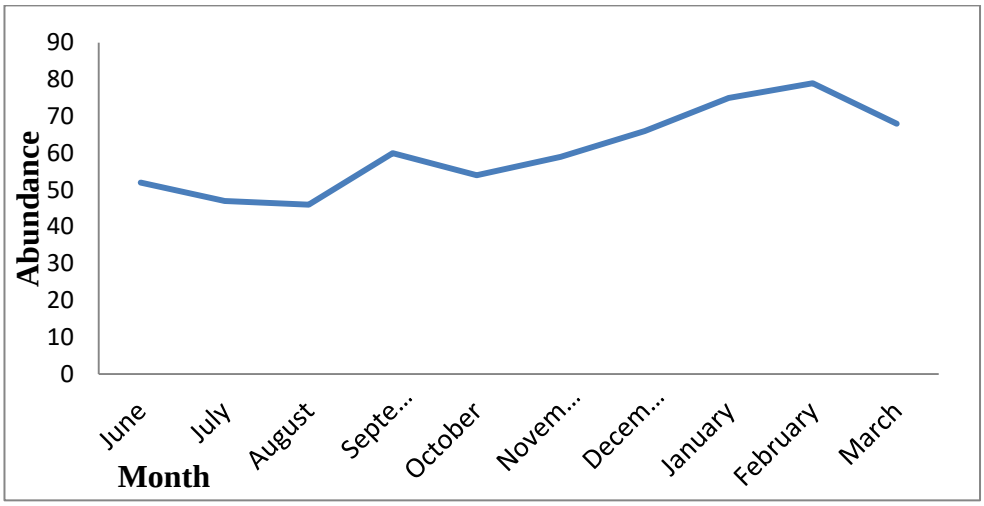

Fig. 1. General population fluctuation of collected jumping spiders.

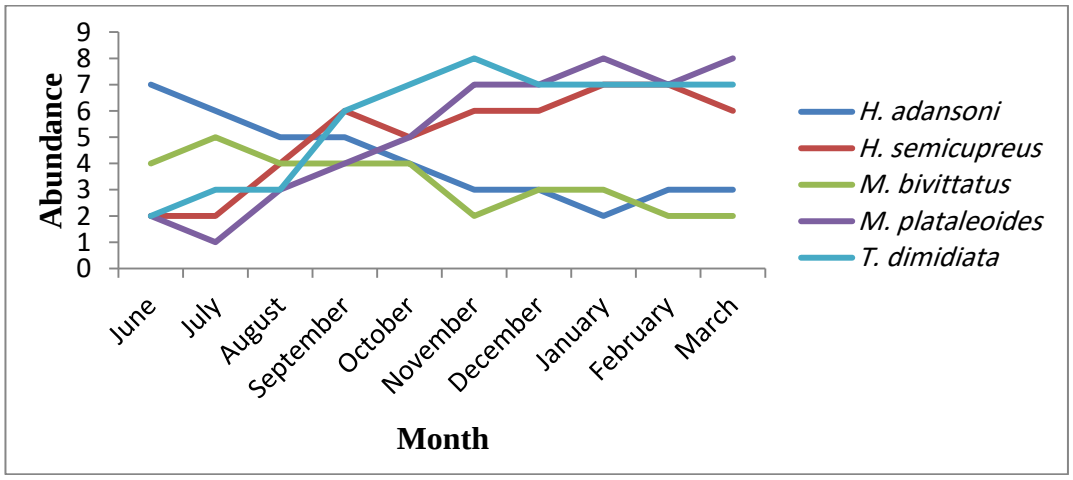

Fig. 2. Population fluctuation of five dominant species of collected jumping spiders.

There are many environmental factors that affect species diversity. Some of these factors include seasonality, spatial heterogeneity, competition, predation, habitat type, environmental stability and productivity (Rosenzweig, 1995). It might be expected that climatic changes through seasons would influence the abundance of spiders (Kato *et al.*, 1995). Spiders live in a well-defined environment with limitations set by both physical conditions and biological factors (Foelix, 1996). They can be grouped into specific functional groups based on the relative distribution and predatory methods (Bultman *et al.*, 1982). Describing the spider diversity in terms of these groups allows greater insights into how habitat differences may be reflected in life history strategies (Lee & Kim, 2003). It might be expected that climatic changes through seasons would influence the abundance of spiders (Kato *et al.*, 1995). In the tropics, a continuum of species with extended seasonal ranges has been found (Basset, 1991), that would give rise to variable

samples at different times of the year. Most spiders are limited to a certain extent by environmental conditions. In general, different species have varying humidity and temperature preferences and are limited to those seasons which offer a microclimate within the range of their physiological tolerances. The population fluctuation also is influenced by migration of spiders since aerial dispersal and colonization of neighbouring habitats are common phenomena among spiders (Bishop, 1990; Bishop & Riechert, 1990; Greenstone, 1999). It is apparent that some of the seasonal differences in the quantity of spiders may be due to temporal changes in prey density and diversity (Warren *et al.*, 1987). Because spiders respond to increases in prey density (Riechert & Gillespie, 1986), pest insect population levels may explain some of the observed differences in spider abundance between two seasons.

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A new species of the genus *Synageles* Simon, 1876 from Turkey (Araneae: Salticidae)

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Abstract

A new species of the genus *Synageles* Simon, 1876, *Synageles karaman* sp. n., is described from the Central Anatolia Region of Turkey on the basis of a male. Differences between the new species and related species are discussed. A morphological description and diagnosis are presented together with figures of the habitus and copulatory organ.

Keywords: Araneae, Salticidae, *Synageles*, new species, Turkey.

Introduction

Salticidae Blackwall, 1841 is the largest family in Araneae and is currently represented by 6244 species belonging to 650 genera in the world (World Spider Catalog, 2020). There are 143 species in 42 salticid genera listed for Turkey (Demir & Seyyar, 2017; Danışman *et al*., 2019). So far, nineteen species have been described in the genus *Synageles*. In Turkey, this genus includes five species; *Synageles albotrimaculatus* (Lucas, 1846), *S. dalmaticus* (Keyserling, 1863), *S. hilarulus* (C.L. Koch, 1846), *S. subcingulatus* (Simon, 1878), and *S. venator* (Lucas, 1836). In the present study, a new species of the genus *Synageles* from Turkey is described.

Material and Methods

The specimen was collected by hand aspirator from Karaman province and preserved in 70% ethanol. All illustrations were made by means of a SZX-16 Olympus

stereomicroscope with a drawing tube. Photos were taken using an Olympus Camedia C-5060 camera. The palpal bulb was removed from the cymbium (Fig. 1E). The length of the leg segments was measured on their dorsal side (Table 1). All measurements are in millimetres and were taken with a millimetric ocular lens. Habitus and terminology of copulatory organs mainly follow Logunov & Rakov (1996) and Metzner (2020). The specimen was deposited in the Arachnology Museum of Niğde Ömer Halisdemir University, Niğde, Turkey (NOHUAM).

Abbreviations used: Fe = femur, Mt = metatarsus, Pa = patella, PLEs = posterior lateral eyes, Ta = tarsus, Ti = tibia.

Results

Synageles karaman sp. n. (Figs. 1A-G)

Material examined: Turkey, Karaman Province, Merkez District, Taşkale Town (37°14'25"N, 33°61'33"E), 25.06.2007, 1♂, from the stony area by handpicking, Leg. A. Topçu. Deposited in the NOHUAM under NOHUAM SAL-39/06.

Etymology: The species name is derived from the name of the type locality.

Description: Male, Habitus ant-like (Fig. 1A). Total length 2.7, Carapace 1.2 long, 0.6 wide, Ocular area 0.6 long, 0.5 wide anteriorly and 0.5 wide posteriorly. Abdomen 1.5 long, 0.6 wide. Colouration: Carapace brown with a white spot between PLEs, black around eyes. Sternum brown. Abdomen elongated, dark grey with a wider white transverse band in the middle on the narrower abdominal part. Legs yellowish with longitudinal black lines. Leg formula: IV-I-III-II. The lengths of the leg segments were measured on their dorsal side (Table 1). The palp with forked tibial apophysis: one tip of the forked tibial apophysis finger-shaped and short, while the other is longer, tapering towards the tip and slightly curved inward at the tip (Figs. F-G). Embolus with tip situated in depression (Figs. C-D). Female: unknown.

Diagnosis: This new species differs from all other *Synageles* by the shape of the embolus and tibial apophysis. The male of *Synageles karaman* sp. n. appears most similar to the male of *S. ramitus* Andreeva, 1976 and its tibial apophysis extends towards the dorsal side of the cymbium like the male of *S. ramitus* (Fig. 1B), but it can be distinguished by the shape of the embolus and the forked tibial apophysis (Fig. 1E).

Also, the male of *Synageles karaman* sp. n. is similar to the male of *S. charitonovi* Andreeva, 1976 by having forked tibial apophysis, but it can be distinguished by the shape of the forked tibial apophysis and it has a longer embolus which is slightly curved at the tip.

In addition to the above features, the male of *S. karaman* sp. n. is distinguished from all other *Synageles* species by the patterns of the dorsal habitus.

Distribution: Only known from the locality where the type material was found.

Table 1. Leg segments measurements of *Synageles karaman* sp. n. (♂).

Leg	**Fe**	**Pa**	**Ti**	**Mt**	**Ta**	**Total length** (except coxa and trochanter)
I	0.65	0.20	0.50	0.45	0.25	2.05
II	0.60	0.15	0.35	0.30	0.17	1.57
III	0.60	0.15	0.35	0.30	0.20	1.60
IV	0.75	0.25	0.55	0.35	0.25	2.15

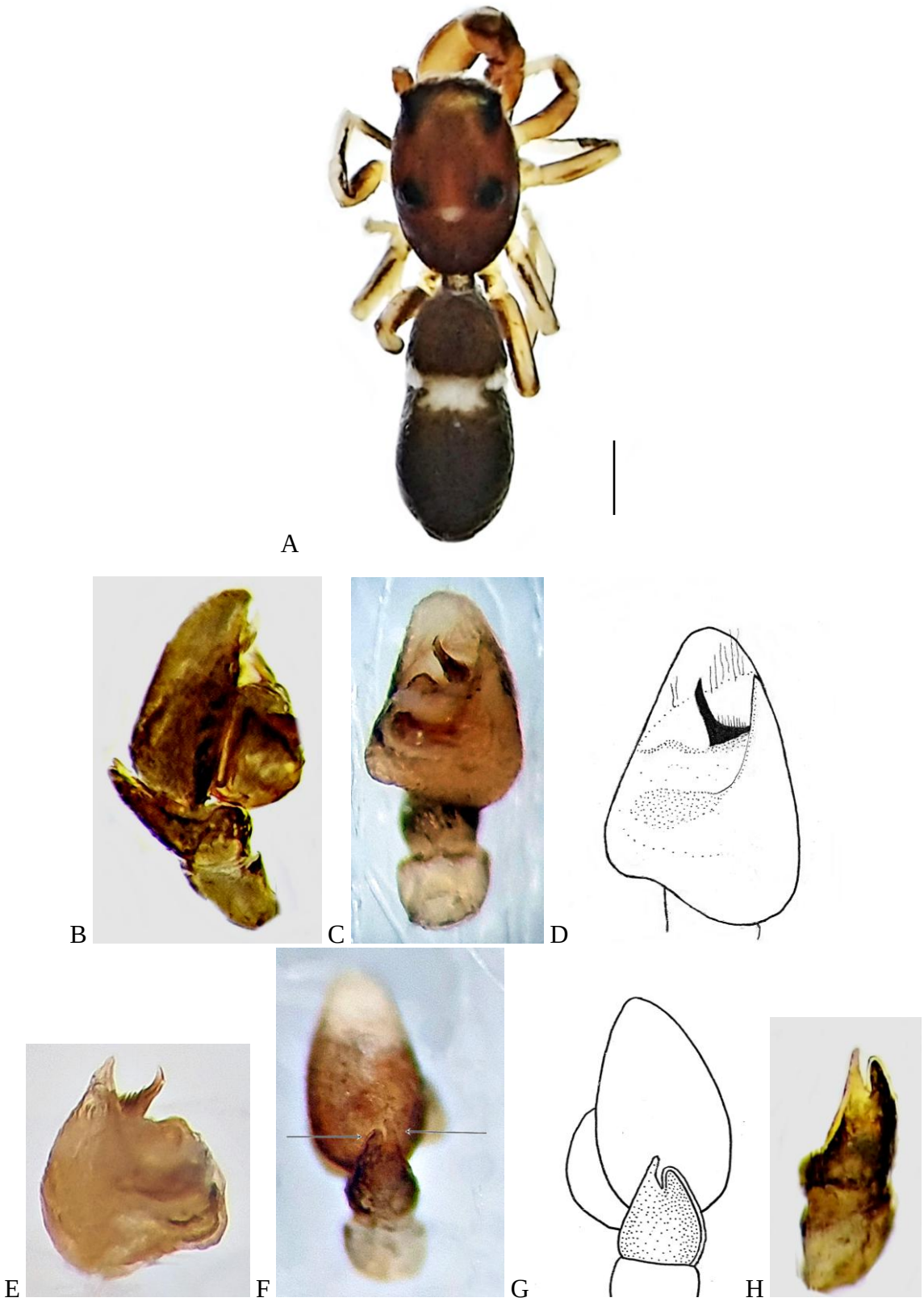

Fig. 1. *Synageles karaman* sp. n., ♂. A. Habitus, dorsal view (Scale bar: 0.5 mm), B-H. Left palp. B. lateral view. C-D. ventral view. E. Palpal bulb, ventral view. F-G. dorsal view, with tibial apophysis (arrows). H. Tibial apophysis, dorsolateral view.

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New distribution records of *Zangherella apuliae* (Caporiacco, 1949) from Turkey (Araneae: Anapidae)

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Abstract

New distribution records and additional information for *Zangherella apuliae* (Caporiacco, 1949), the only known species of Anapidae in Turkey, are presented.

Keywords: Spider, Anapidae, *Zangherella apuliae*, MSS trap, Turkey.

Introduction

The Anapidae Simon, 1895 is small sized and a relatively small family of spiders with 233 described species under 58 genera in the world (World Spider Catalog, 2020). The members of the family are distributed in many parts of the world especially in the tropical areas. They prefer humid and temperate forests in the leaf litter and under the barks as their habitat.

The genus *Zangherella* Caporiacco, 1949 was firstly described under the spider family Theridiidae by Caporiacco (1949) and was transferred to Symphytognathidae by Levi & Levi (1962). Later, the genus was considered in Anapidae by Brignoli (1981). The genus is represented by three species mainly limited to the Mediterranean region: *Z. algerica* (Simon, 1895) (Italy, Algeria and Tunisia), *Z. apuliae* (Caporiacco, 1949) (Italy, Greece and Turkey) and *Z. relicta* (Kratochvíl, 1935) (Montenegro and Bulgaria).

The only known species of Anapidae in Turkey is *Z. apuliae* (Caporiacco, 1949). The species was firstly collected by sifting the leaf litter of a pine forest from Salihli District in Manisa Province located in Aegean region in 1975 and later it was published by Brignoli (1978) as a new family record for Turkey.

Z. apuliae is distributed in Turkey, Italy and Greece and it is adapted in the MSS (Mesocavernous Shallow Stratum) habitats and troglophilic life (Deltshev *et al.*, 2011; Mammola *et al.*, 2018; World Spider Catalog, 2020).

Our work aims to add new locality records and extent to the known distribution range of *Z. apuliae* in Turkey.

Material and Methods

The spiders were collected by using MSS (Mesovoid Shallow Substratum) trap and Berlese Funnel trapping methods from İzmir and Manisa Provinces which are located in Aegean Region. The MSS trap design methodology is based on López & Oromí (2010) with some changes to increase to effectiveness of the traps. The samples were preserved in 70% ethanol. Digital images of the species were taken with a Leica DFC295 digital camera attached to a Leica S8AP0 stereomicroscope.

Abbreviations used: AL = abdomen length, AME_d = anterior median eye diameter, CL = carapace length, Cw_{max} = maximum carapace width, Cw_{min} = minimum carapace width, Fe = femur, Mt = metatarsus, Pa = patella, PLE_d = posterior lateral eye diameter, PME_d = posterior median eye diameter, Ti = tibia, Ta = tarsus. All measurements are in millimetres (mm). The specimens were preserved in the collection of the Zoological Museum, Department of Biology, Uludağ University, Bursa, Turkey.

Results

Taxonomy

Family **Anapidae** Simon, 1895

Genus ***Zangherella*** Caporiacco, 1949

Species ***Zangherella apuliae*** (Caporiacco, 1949)

Material examined [36♀♀, 45♂♂, 3 juveniles]

İzmir Province [8♀♀, 7♂♂]**.** 1♂, Yamanlar Mountain (38°33'31"N, 27°13'09"E), asl 831 m, MSS trap, 20.06.2016-10.12.2016, leg. E.A.Yağmur — 1♂, Yamanlar Mountain (38°33'31"N, 27°13'09"E), asl 831 m, MSS trap, 17.04.2017-24.11.2017, leg. E.A. Yağmur — 2♀♀, Kemalpaşa District, Nif Mountain (38°23'20"N, 27°23'30"E), asl 955 m, MSS trap, 01.06.2018-20.10.2018, leg. E.A. Yağmur & S. Örgel — 2♂♂, Yamanlar Mountain (38°33'31"N, 27°13'07"E), asl 930 m., Berlese funnel, 02.06.2018, leg. E.A. Yağmur — 1♂, Yamanlar Mountain (38°33'31"N, 27°13'09"E), asl 831 m., MSS trap, 08.05.2019-30.11.2019, leg. E.A. Yağmur — 6♀♀, Kemalpaşa District, Nif Mountain (38°22'47"N, 27°22'18"E), asl 1126 m., MSS trap, 20.05.2019-20.10.2019, leg. E.A. Yağmur & S. Örgel — 2♂♂, Kemalpaşa District, Nif Mountain (38°23'20"N, 27°23'30"E), asl 955 m., MSS trap, 20.05.2019-20.10.2019, leg. E.A. Yağmur & S. Örgel.

Manisa Province [28♀♀, 38♂♂, 3 juveniles]**.** 1♂, Salihli District, Bozdağlar Village, 10 km South (38°25'00"N, 28°05'03"E), 922 m, MSS trap, 27.10.2016-17.03.2017, leg. E.A. Yağmur & S. Örgel — 2 juveniles, Alaşehir District, Dağarlar Village (38°11'49"N, 28°28'51"E), asl 576 m, MSS trap, 16.03.2017-16.10.2017, leg. E.A. Yağmur & S. Örgel — 3♀♀, 7♂♂, Alaşehir District, Dağarlar Village (38°11'49"N, 28°28'51"E), asl 576 m, MSS trap, April-12.10.2017, leg. E.A. Yağmur & S. Örgel — 1 juvenile, Alaşehir District, Dağarlar Village (38°11'49"N, 28°28'51"E), asl 576 m, MSS trap, 23.05.2018-

01.10.2018, leg. E.A. Yağmur & S. Örgel — 1♀, 2♂♂, Dağarlar Village (38°11'49"N, 28°58'51"E), asl 576 m., Berlese funnel, 02.06.2018, leg. E.A. Yağmur & S. Örgel — 1♀, 3♂♂, Turgutalp Village, Spil Mountain (38°34'06"N, 27°23'59"E), asl 1028 m, MSS trap, 01.06.2018-20.10.2018, leg. E.A Yağmur — 1♀, 1♂, Salihli District, Bozdağlar Village, 10 km South (38°23'03"N, 38°05'03"E), asl 922 m., MSS trap, 07.05.2019-17.10.2019, leg. E.A. Yağmur & S. Örgel — 7♀♀, 7♂♂, Spil Mountain (38°34'07"N, 27°24'04"E), asl 1028 m., MSS trap, 20.05.2019-20.10.2019, leg. E.A. Yağmur — 8♀♀, 8♂♂, Alaşehir District, Dağarlar Village (38°11'49"N, 28°28'51"E), asl 576 m., MSS trap, 20.05.2019-17.10.2019, leg. E.A. Yağmur & S. Örgel — 2♀♀, 1♂, Alaşehir District, Turcuk Village (38°13'49"N, 28°35'00"E), asl. 376 m., MSS trap, 20.05.2019-17.10.2019, leg. E.A. Yağmur & S. Örgel — 1♀, 5♂♂, Alaşehir District, Turcuk Village (38°13'49"N, 28°35'00"E), asl. 376 m., MSS trap, 20.05.2019-17.10.2019, leg. E.A. Yağmur & S. Örgel — 4♀♀, 3♂♂, Alaşehir District, Dağarlar, (38°11'49"N; 28°28'51"E), asl. 576 m., MSS trap, 20.05.2019-17.10.2019, leg. E.A. Yağmur & S. Örgel.

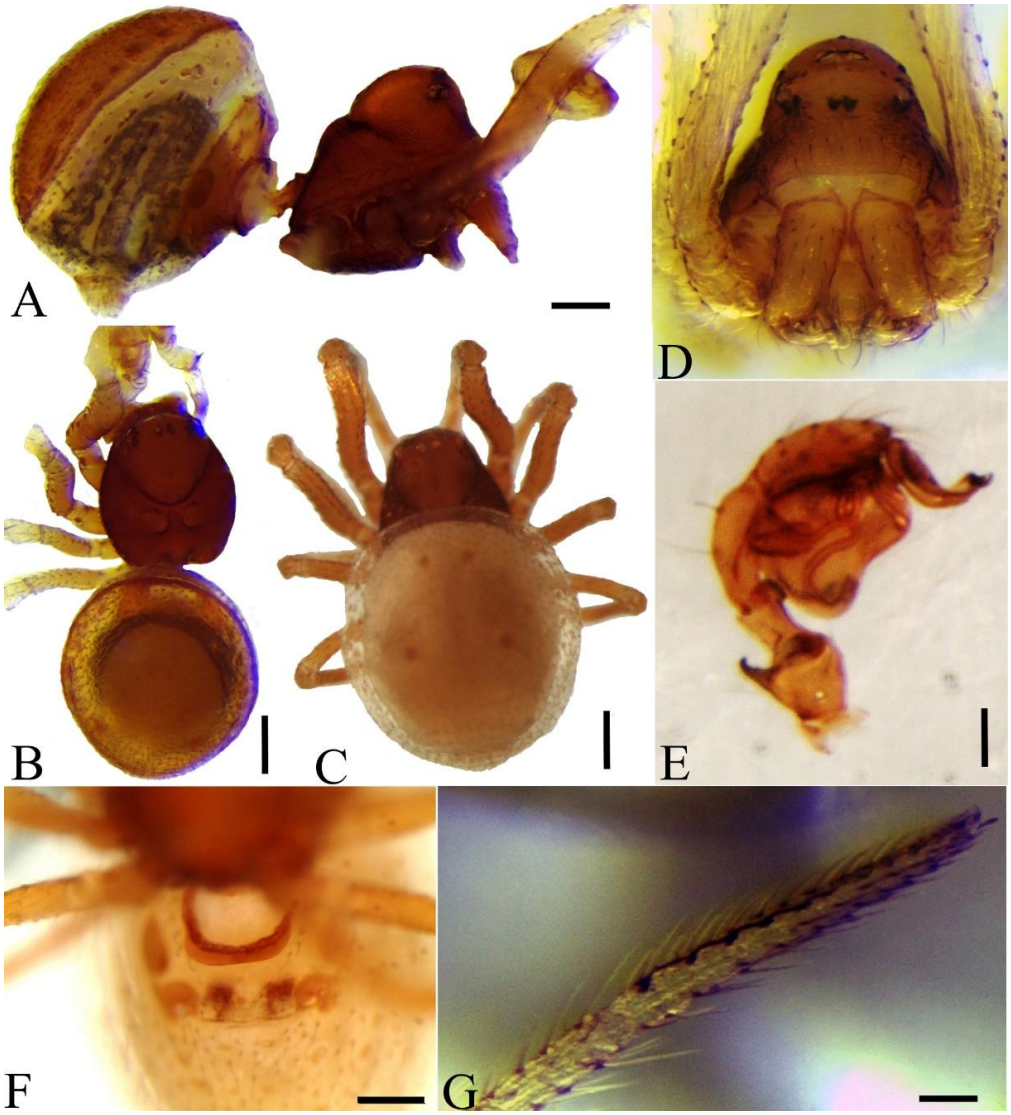

Fig. 1. *Zangherella apuliae* (Caporiacco, 1949).
A-B. Male habitus. A. lateral view. B. dorsal view. C. Female habitus, dorsal view. D. Female prosoma, frontal view. E. Male palp, retrolateral view. F. Female abdomen, ventral view. G. Male leg I, ventral view. (Scale bars: A, B, C 0.2; E, G 0.1; F 0.3)

Female (Figs. 1C, D, F). Cephalothorax uniformly reddish-brown, circular shaped with cephalic region convex and higher, thoracic region with two protuberances. Clypeus is high and reddish-brown, wider than the length of chelicerae. Chelicerae are pale. Ocular area is the highest point of carapace. Labium is nearly triangular and wider at the base. Sternum is reddish-brown heart-shaped and bordered by a thin dark line. Legs lighter than carapace and their measurements are given in Table (1). Abdomen is globular, lighter than carapace and without scutum.
Male (Figs. 1A-B, E, G, 2A-D)**.** As female, except for the following: Abdomen is globular and with reddish-brown wide dorsal and small ventral scutum.
Measurements (♀/♂): **AL** 0.50 / 0.89; **CL** 0.50 / 0.55–0.56; **Cw_{max}** 0.42 / 0.42–0.51; **Cw_{min}** 0.28/ 0.29–0.30; **AME_d** 0.031 / 0.031–0.047; **PLE_d** 0.031 / 0.047–0.062; **PME_d** 0.050 / 0.031–0.047.

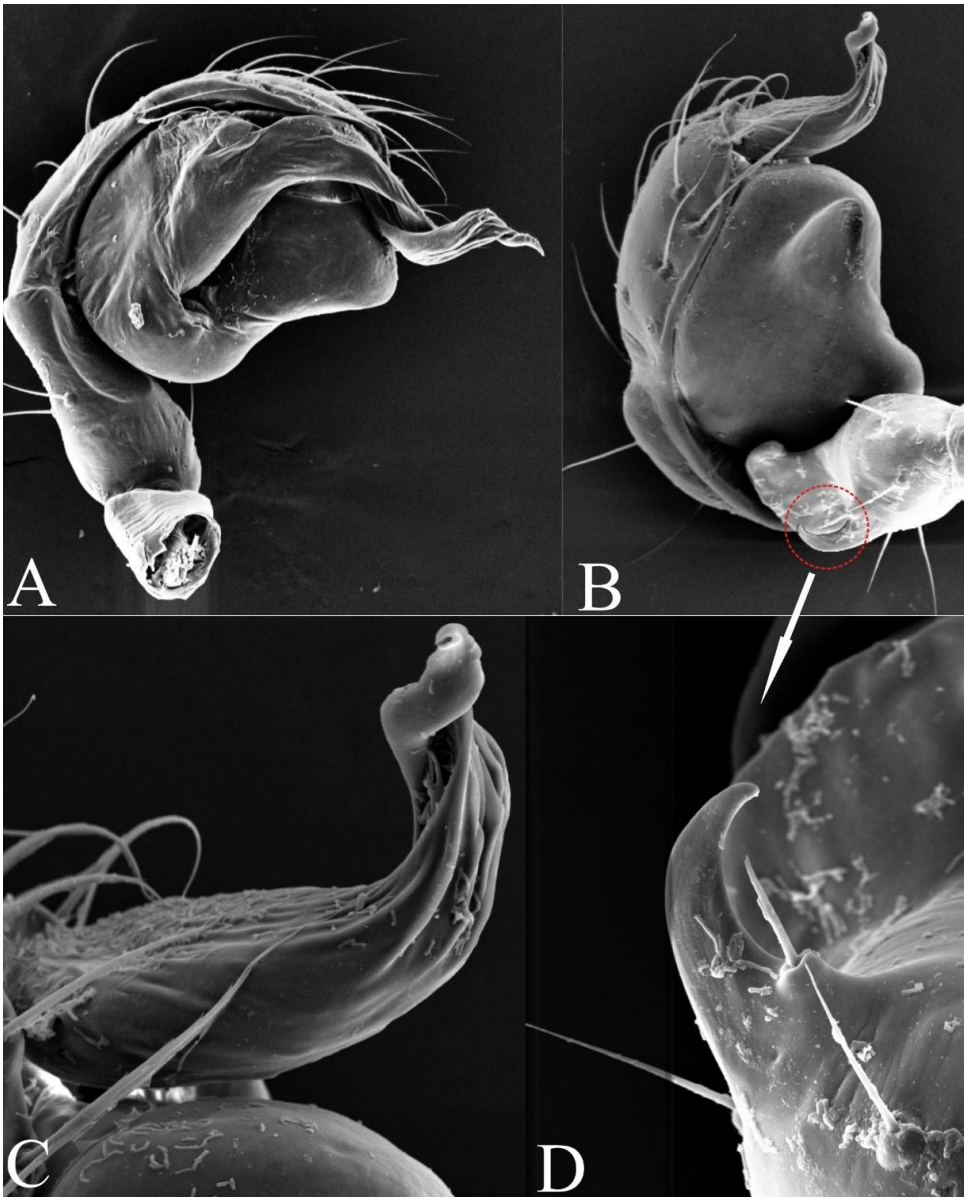

Fig. 2. *Zangherella apuliae* (Caporiacco, 1949). Male palp.
A. Retrolateral view. B. Nearly retrolateral view. C. Detail of embolus, nearly retrolateral view. D. Retrolateral tibial apophysis.

Table 1. Leg segments measurements of *Zangherella apuliae* (♀/♂).

Legs	I	II	III	IV
Fe	0.56 / 0.56–0.66	0.39 / 0.40–0.48	0.29 / 0.34–0.37	0.31 / 0.41–0.42
Pa	0.13 / 0.15–0.16	0.11 / 0.14–0.16	0.10 / 0.12–0.14	0.12 / 0.14–0.19
Ti	0.43 / 0.55–0.63	0.39 / 0.50–0.51	0.31 / 0.37–0.43	0.37 / 0.47–0.47
Mt	0.37 / 0.47–0.60	0.34 / 0.43–0.47	0.30 / 0.39–0.40	0.32 / 0.41–0.47
Ta	0.08 / 0.08–0.08	0.08 / 0.07–0.07	0.08 / 0.07–0.07	0.08 / 0.08–0.08
Total	1.57 / 1.81–2.13	1.31 / 1.47–1.69	1.08 / 1.29–1.41	1.20 / 1.51–1.63

Known record in the literature. Vil. Manisa - Salihli, m 500, 29.IV.75, C. Besuchet & I. Löbl leg., 2♂♂, 1♀ (MHNG [Muséum d'Histoire Naturelle, Genève]; loc. 3*b*: vagliando foglie morte in foresta di pini [sifting dead leaves in pine forest]) (Brignoli, 1978: 499).

Results and Discussion

Z. apuliae was firstly described, as *Pseudanapis apuliae*, by Caporiacco (1949) from Cavea Zinzulusa in Italy. Later, Brignoli (1968) redescribed and discussed the validity of this species and he suggested that it might be a synonym of *Z. relicta*. In another paper by Brignoli (1974), the species was recorded from Kefalonia and Lefkada Islands in Greece. Thaler & Knoflach (1998) examined the additional material and compared the *Z. algerica* and *Z. apuliae*. The later authors underlined the primary differences are tarsus I prolaterally with 6 spines in *Z. apuliae* while with 4 in *Z. relicta.* In the present study, unfortunately, we did not examine any sample of *Z. relicta* to compare with *Z. apuliae*, but we identified our samples as *Z. apuliae* based on the number of tarsus I spines and palpal organ structure.

In this study, the species is collected by using MSS traps and Berlese funnel traps. Also, *Z. relicta* is recorded in MSS traps from Bulgaria by Deltshev *et al.* (2011), and the authors mentioned that the members of the genus occur only in deeper subterranean habitats. Further studies with MSS trapping method are essential to gain a better knowledge of genus *Zangherella* in Turkey.

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Faunal diversity of Liocranidae, Mimetidae, Miturgidae, Nesticidae and Oecobiidae (Arachnida: Araneae) of India

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Abstract

The present article deals with the faunal diversity of five families of araeneomorph spiders, viz. Liocranidae, Mimetidae, Miturgidae, Nesticidae, and Oecobiidae (Arachnida: Araneae) in different Indian states and union territories. None of the spider species of these families is recorded from Assam, Goa, Himachal Pradesh, Jharkhand, Ladakh, Lakshdweep, Mizoram, Nagaland, Punjab, Sikkim, Telangana, and Tripura. Among these, the largest family is Liocranidae which is represented by 30 species belonging to 5 genera, out of which 28 are endemic. Other families are very poorly represented in India. Single species was recorded both in Miturgidae and Nesticidae, 3 species in Mimetidae and 7 species in Oecobiidae are recorded. Only two species, *Oedignatha scrobiculata* Thorell, 1881 and *Oecobius putus* Pickard-Cambridge, 1876 are widely distributed. Maximum number of spider species of these families were recorded in Tamil Nadu (16 species) followed by Kerala (11 species), Maharashtra (10 species), Gujarata (8 species), Odisha, Madhya Pradesh, West Bengal and Uttarakhand (6 species each), and Andhra Pradesh and Karnataka (4 species each) and less number in other states and union territories. Out of 42 species recorded of these 5 families, 34 species are endemic and one species seem to be erroneous record.

Keywords: Spiders, Liocranidae, Mimetidae, Miturgidae, Nesticidae, Oecobiidae, Faunal Diversity, India.

Introduction

Spiders (Arachnida: Araneae) are predatory and consume mostly insects both in nature and agricultural ecosystem and their predatory effect on prey can be enhanced in agricultural ecosystems by increasing their population as well as by their conservation (Riechert & Lockley, 1984). However, they have received very little consideration as far as their conservation is concerned. Only few tarantulas in India are listed in IUCN Red List (Molur *et al.*, 2008) and immediate action is needed to conserve them to prevent their extinction (Siliwal *et al.*, 2011). In spite of current researches on diversity and distribution of spiders in India, their number is meagre as compared to other regions of the world. Out of 48,941 described species under 4,191 genera and 128 families in the world (World Spider Catalog, 2020), only 1854 species belonging to 470 genera in 61 families are known in India (Caleb & Sankaran, 2020). Recently, Singh & Singh (2020) and Singh *et al.* (2020a,b,c,d,e,f) updated the distribution pattern of certain families of spiders in India.

The present article deals with the faunal diversity of five families of araeneomorph spiders, viz. Liocranidae, Mimetidae, Miturgidae, Nesticidae, and Oecobiidae (Arachnida: Araneae) in different Indian states and union territories. The information of these families is very meagre and underrepresented in India and the available literature are also scattered and not updated so far regarding their distribution pattern across the country. Therefore, this present work was taken up to provide up-to-date information of these families in the light of modern taxonomic concept like previous ones (Singh *et al.*, 2020a,b,c,d,e,f). Several species reported and described from India appear to be either misidentified or reported erroneously as these species are not identified by seeking help of spider taxonomist (Singh & Singh, 2020). Hence, such reports need re-examination. In addition, there are several mistakes in their scientific names even in the recent ones because such contents become outdated quickly and, due to their perceived comprehensiveness, readers sometimes ignore newer sources of data (Singh *et al.*, 2020f). In addition, researches are continuous on the spider taxonomy with the description of newer taxa, their modified status, and the publication of other nomenclatural decisions (Singh *et al.*, 2020a,f).

Material and Methods

This checklist is prepared on the basis of published literature in surveys, books, journals, theses and World Spider Catalog up to 15 November, 2020. In the present checklist, attempts have been made to correct any mistakes in the scientific names of the spiders. Only those synonymies were referred that were reported in India. For other synonymies, World Spider Catalog (2020) may be consulted. All the endemic species are marked with (*). Seemingly erroneous records are marked with (♠). If the spider species is not endemic, its elsewhere distribution is also provided.

Results and Discussion

A. Faunal Diversity of the Family Liocranidae Simon, 1897

Liocranidae is a family of small to medium-sized araneomorph spiders, commonly called as spiny-legged sac spiders. They are ground dwellers or running foliage spiders like some other groups of spiders. No truly synapomorphic character was observed that could delimit the family (Bosselaers, 2009), however following sets of characters differentiate them from other families: eight eyes arranged in two rows,

anterior row straight, posterior row procurved or recurved; the fourth pair of legs usually is longer than the other legs, metatarsi and tibiae of the first two pairs of legs having several pairs of spines ventrally, two tarsal claws; and the prosoma and abdomen ovoid slightly widening toward posterior end (Jocqué & Dippenaar-Schoeman, 2006). Females used to live in animal burrows while males roam and most often caught in pitfall traps. Few species simply live on ground in leaf litters. The liocranid spiders are nocturnal and free-hunter but like other spiders, they do not construct silken retreat to hide themselves during daytime, instead sit under stones or other objects. Some species of this family live in symbiosis with ants and termites. Liocranidae is a small family consisting of only 290 species described under 32 genera worldwide (World Spider Catalog, 2020). In India, 30 species described under 5 genera are recorded from different states and union territories, out of which 28 species are strictly endemic; *Oedignatha* Thorell, 1881 was the largest genus containing 18 species (Fig. 1). Following is the list of species distributed in different states and union territories of India.

Fig. 1. Distribution of spiders belonging to different families in Indian states and union territories (L = Liocranidae, M = Mimetidae, Mt = Miturgidae, N = Nesticidae, O = Oecobiidae).

1. *Agroeca gangotrae* Biswas & Roy, 2008 *
- Uttarakhand (Biswas & Roy, 2008)

2. *Apostenus annulipes* Caporiacco, 1935 *
- Jammu & Kashmir (Caporiacco, 1935)

3. *Oedignatha adhartali* (Gajbe, 2003) *
=*Castianeira adhartali* Gajbe, 2003
- Madhya Pradesh (Gajbe, 2003; Sankaran *et al.*, 2019)
- Rajasthan (Malhotra *et al.*, 2019)

4. *Oedignatha albofasciata* Strand, 1907 *
- Karnataka (Strand, 1907, 1909; Majumder & Tikader, 1991)
- Kerala (Joseph *et al.*, 2017)

5. *Oedignatha andamanensis* (Tikader, 1977) *
=*Amaurobius andamanesis* Tikader, 1977
- Andaman & Nicobar Islands (Tikader, 1977)
- Karnataka (Nijagal *et al.*, 2020)

6. *Oedignatha binoyii* Reddy & Patel, 1993 *
- Gujarat (Reddy & Patel, 1993)

7. *Oedignatha carli* Reimoser, 1934 *
- Bihar (Biswas & Biswas, 1992)
- Kerala (Sudhikumar *et al.*, 2005; Sunil Jose *et al.*, 2008; Adarsh & Nameer, 2015)
- Manipur (Majumder & Tikader, 1991)
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)
- West Bengal (Majumder & Tikader, 1991; Biswas & Biswas, 1992; Majumder & Talukdar, 2013)

8. *Oedignatha dentifera* Reimoser, 1934 *
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

9. *Oedignatha escheri* Reimoser, 1934 *
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

10. *Oedignatha indica* Reddy & Patel, 1993 *
- Andhra Pradesh (Reddy & Patel, 1993)

11. *Oedignatha indica* (Tikader, 1981) *
=*Castianeira indica* Tikader, 1981
- Gujarat (Patel & Pillai, 1988; Parmar *et al.*, 2015)
- Jammu & Kashmir (Khan, 2006)
- Maharashtra (Tikader, 1981; Majumder & Tikader, 1991; Biswas & Biswas, 1992; Rithe, 2012; More & Sawant, 2013; More, 2015; Dhali *et al.*, 2017)
- Uttar Pradesh (Hore & Uniyal, 2008)
- West Bengal (Majumder & Tikader, 1991; Biswas & Biswas, 1992; Majumder & Talukdar, 2013; Dhali *et al.*, 2017)

12. *Oedignatha lesserti* Reimoser, 1934 *
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

13. *Oedignatha microscutata* Reimoser, 1934 *
- Kerala (Sunil Jose *et al.*, 2008)
- Maharashtra (Meshram, 2011)
- Odisha (Majumder & Tikader, 1991; Biswas, 1987; Ramakrishna *et al.*, 2006)
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017; Caleb, 2020a)

14. *Oedignatha poonaensis* Majumder & Tikader, 1991 *
- Maharashtra (Majumder & Tikader, 1991; Meshram, 2011; Rithe, 2012)

15. *Oedignatha procerula* Simon, 1897 *
- Uttarakhand (Simon, 1897; Majumder & Tikader, 1991; Biswas & Biswas, 2010)

16. *Oedignatha raigadensis* Bastawade, 2006 *
=*Amaurobius indicus* Bastawade, 2002 [misplaced]
=*Oedignatha indica* (Bastawade, 2002)
- Arunachal Pradesh (Bastawade, 2006)
- Maharashtra (Bastawade, 2002)

17. *Oedignatha scrobiculata* Thorell, 1881
=*Castianeira bengalensis* Biswas, 1984
- Andhra Pradesh (Majumder, 2005)
- Bihar (Biswas & Biswas, 1992; Majumder, 2005)
- Gujarat (Yadav *et al.*, 2017)
- Karnataka (Gravely, 1931)
- Kerala (Biswas & Biswas, 1992; Majumder, 2005; Joseph *et al.*, 2017)
- Maharashtra (Majumder & Tikader, 1991; Bastawade & Khandal, 2006; More & Sawant, 2013; More, 2015; Sankaran *et al.*, 2019)
- Odisha (Gravely, 1921, 1931; Biswas, 1987; Majumder & Tikader, 1991)
- Puducherry (Simon, 1906)
- Tamil Nadu (Gravely, 1931; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017; Caleb, 2020b)
- West Bengal (Gravely, 1931; Biswas, 1984; Biswas & Biswas, 1992; Majumder & Tikader, 1991; Majumder, 2005; Majumder & Talukdar, 2013; Sankaran *et al.*, 2019)

  Elsewhere: Germany, Indonesia, Madagascar, Malaysia, Philippines, Reunion, Seychelles, Taiwan, Thailand.

18. *Oedignatha shillongensis* Biswas & Majumder, 1995 *
- Meghalaya (Biswas & Majumder, 1995)

19. *Oedignatha tricuspidata* Reimoser, 1934 *
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

20. *Oedignatha uncata* Reimoser, 1934 *
- Tamil Nadu (Reimoser, 1934; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

21. *Oedignatha* sp.
- Gujarat (Yadav *et al.*, 2017; Solanki *et al.*, 2020)
- Kerala (Sunil Jose *et al.*, 2008; Abhilash & Kumar, 2018; Rajeevan *et al.*, 2019)
- Odisha (Siliwal *et al.*, 2008)
- Rajasthan (Kaur *et al.*, 2014)
- Uttar Pradesh (Hore & Uniyal, 2008)
- Uttarakhand (Uniyal *et al.*, 2011)

22. *Paratus indicus* Marusik, Zheng & Li, 2008 *
- Kerala (Joseph *et al.*, 2017)
- Uttarakhand (Marusik *et al.*, 2008)

23. *Paratus perus* Sankaran, Malamel, Joseph & Sebastian, 2017 *
- Kerala (Sankaran *et al.*, 2017)

24. *Sphingius barkudensis* Gravely, 1931
- Karnataka (Gravely, 1931)
- Odisha (Gravely, 1931; Biswas, 1987; Majumder & Tikader, 1991)
- Tamil Nadu (Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

Elsewhere: Bangladesh.

25. *Sphingius bilineatus* Simon, 1906 *
- Kerala (Majumder & Tikader, 1991)
- Puducherry (Simon, 1906)
- Tamil Nadu (Gravely, 1931)

26. *Sphingius caniceps* Simon, 1906 *
- Odisha (Majumder & Tikader, 1991; Biswas & Biswas, 1992; Majumder, 2005)
- Tamil Nadu (Simon, 1906; Gravely, 1931; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)
- West Bengal (Biswas & Biswas, 1992; Majumder, 2005)

27. *Sphingius delakharae* Pawaria, Bodkhe, Kamble, Uniyal & Talwar, 2018 *
- Madhya Pradesh (Pawaria *et al.*, 2018)

28. *Sphingius kambakamensis* Gravely, 1931 *
- Tamil Nadu (Gravely, 1931; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

29. *Sphingius longipes* Gravely, 1931 *
- Kerala (Gravely, 1931; Majumder & Tikader, 1991)

30. *Sphingius nilgiriensis* Gravely, 1931 *
- Tamil Nadu (Gravely, 1931; Majumder & Tikader, 1991; Karthikeyani *et al.*, 2017)

31. *Sphingius paltaensis* Biswas & Biswas, 1992 *
- West Bengal (Biswas & Biswas, 1992; Majumder, 2005)

32. *Sphingius* sp.
- Odisha (Gravely, 1921)

B. Faunal Diversity of the Family Mimetidae Simon, 1881

The spiders of the family Mimetidae are commonly called pirate spiders. Mimetids are usually yellow and brown and measure 3 to 7 mm long. These spiders have a characteristic row of large spine-like hairs on the first pair of legs, the row consists of a long spine, followed by a series of progressively shorter ones. The mimetid spiders are found in forests worldwide, being highest diversity in Central and Tropical South America (Benavides *et al.*, 2017). The pirate spiders are web-invading araneophagic spiders which use vibratory aggressive mimicry. These spiders do not build web but hang under leaves and hunt passing spiders by extension of their long legs. Few spiders attack spider webs, and few lure males of other species to their deaths by imitating the courtship display of that species (Foelix, 2010). Mimetidae is a small family containing only 154

species under 8 genera globally (World Spider Catalog, 2020). In India, only 3 species described under 2 genera are recorded from different states, and all are endemic (Fig. 1). Following is the list of species distributed in different states of India.

1. *Melaenosia pustulifera* Simon, 1906 *
- Tamil Nadu (Simon, 1906; Karthikeyani *et al.*, 2017)

2. *Mimetus indicus* Simon, 1906 *
- Madhya Pradesh (Keswani, 2014)
- Maharashtra (Rithe, 2012)
- Tamil Nadu (Simon, 1906; Karthikeyani *et al.*, 2017)

3. *Mimetus tikaderi* Gajbe, 1992 *
- Chhattisgarh (Gajbe, 1992, Gajbe, 2007; Gajbe, 2003)

4. *Mimetus* sp.
- Gujarat (Yadav *et al.*, 2017)
- Kerala (Sunil Jose *et al.*, 2008)
- Odisha (Choudhury *et al.*, 2019)
- Uttarakhand (Uniyal *et al.*, 2011)

C. Faunal Diversity of the Family Miturgidae Simon, 1886

The spiders of the family Miturgidae are commonly called as prowling spiders. They are of medium to large sized spiders with prosoma squared off at the front, and the fovea runs lengthways; have 8 eyes in two rows of 4 each, two tarsal claws with claw tufts and the ends of their posterior lateral spinnerets are conical to elongate. They do not spin web. Mostly they are nocturnal hunter and live on the ground and are cryptic and guard their eggs in a sac-like retreat under rock or other debris. Miturgidae is also a small family containing only 136 species under 29 genera globally (World Spider Catalog, 2020). In India, only one species was reported in Kerala and Odisha (Fig. 1). Following is the distribution list in different states of India.

1. *Palicanus caudatus* Thorell, 1897
=*Systaria barkudensis* (Gravely, 1931)
=*Syrisca barkudensis* Gravely, 1931
- Kerala (Sankaran & Sebastian, 2019)
- Odisha (Gravely, 1931; Biswas, 1987; Majumder & Tikader, 1991)

Elsewhere: China, Indonesia, Myanmar, Reunion, Seychelles.

D. Faunal Diversity of the Family Nesticidae Simon, 1894

Nesticidae is also a small family of spiders commonly known as cave cobweb spiders or scaffold web spiders. These spiders have a comb of serrated bristles on the hind tarsi that are used to pull silk bands from the spinnerets. The majority of nesticid spiders are found in temperate areas of the Holarctic realm where they are mainly restricted to cave-like environments, while others live in forest litter, on grass and under stones (Lin *et al.*, 2016). So far, only 279 species belonging to 16 genera are described worldwide (World Spider Catalog, 2020). However, In India, only single species is recently reported from Uttarakhand (Fig. 1).

1. *Nesticella nepalensis* (Hubert, 1973)
- Uttarakhand (Lin *et al.*, 2016)

Elsewhere: China, Nepal.

E. Faunal Diversity of the Family Oecobiidae Blackwall, 1862

The spiders of the family Oecobiidae, also called as disc web spiders or star-legged spiders, is a small family containing 119 species belonging to 6 genera worldwide (World Spider Catalog, 2020). They are small to medium sized spiders measuring 2-20 mm long (More, 2016), larger ones usually live in desert. They have following set of characters for diagnosis: legs short and strong, spiny, subequal in length, tarsi armed with three claws, first two pairs of many oecobiids point forward then curve backwards; posterior spinnerets much longer than the anterior ones; presence of anal-gland bearing a tuft of hairs; and the carapace is widely rounded bearing a compact group of six to eight eyes medially situated near the front of its dorsal surface. These spiders, usually construct small temporary star-shaped webs on or under stones, or on wall and hide nearby and prey mostly on ants. Some spiders spin small saccular tent-like webs close to ceilings in human dwellings. In India, only 7 species are recorded under 2 genera in different states and union territories, out of which 3 species are endemic, and record of one species *Oecobius navus* Blackwall, 1859 from Haryana seems to be erroneous (Fig. 1). Following is the list of species of Oecobiidae distributed in different states and union territories of India.

1. *Oecobius chiasma* Barman, 1978 *
- Maharashtra (Rithe, 2012)
- Meghalaya (Barman, 1978)

2. *Oecobius marathaus* Tikader, 1962
- Andhra Pradesh (Rao *et al.*, 2005)
- Maharashtra (Tikader, 1962; Meshram, 2011; Rithe, 2012)

Elsewhere: Australia, Brazil, Japan, Laos, Madagascar, Taiwan, Tropical Africa.

3. *Oecobius navus* Blackwall, 1859 (♠)
- Haryana (Malik & Goyal, 2017)

Elsewhere: Canada, China, Europe, Japan, Korea, New Zealand, northern Africa, South America, USA.

4. *Oecobius putus* O. Pickard-Cambridge, 1876
- Andhra Pradesh (Rao *et al.*, 2005)
- Gujarat (Patel & Vyas, 2001; Siliwal *et al.*, 2003; Yadav *et al.*, 2017; Thumar, 2019)
- Kerala (Patel, 2003)
- Madhya Pradesh (Gajbe, 2003; Gajbe, 2007; Patil, 2012)
- Maharashtra (Tikader, 1962; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Gajbe, 2007; Majumder, 2005; Nerlekar *et al.*, 2016)
- Rajasthan (Chauhan *et al.*, 2009; Kumari *et al.*, 2017)
- Tamil Nadu (Tikader, 1962; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Gajbe, 2007; Majumder, 2005; Caleb, 2020a, b)
- West Bengal (Tikader, 1962; Tikader & Biswas, 1981; Biswas & Biswas, 1992; Gajbe, 2007; Majumder, 2005; Majumder & Talukdar, 2013)

Elsewhere: Azerbaijan, Egypt, Pakistan, Mexico, Sudan to Iran, USA.

5. *Oecobius* sp.
- Bihar (Priyadarshini *et al.*, 2015)
- Delhi (Malik *et al.*, 2015)
- Gujarat (Parmar *et al.*, 2015)
- Ladakh (Uniyal, 2006)

- Rajasthan (Jangid *et al.*, 2019)
- Tamil Nadu (Sherriffs, 1919)
- Uttarakhand (Uniyal *et al.*, 2011; Gupta & Siliwal, 2012)

6. *Uroctea indica* Pocock, 1900 *
- Gujarat (Thumar, 2019)
- Madhya Pradesh (Gajbe, 2004)
- Maharashtra (Pocock, 1900; Gajbe, 2004; Rithe, 2012)
- Rajasthan (Sivaperuman & Rathore, 2004; Gajbe, 2004; Jangid *et al.*, 2019)
- Madhya Pradesh (Gajbe, 2003; Gajbe, 2007; Dhali *et al.*, 2017; Patil, 2012)

7. *Uroctea manii* Patel, 1987 *
- Gujarat (Patel, 1987)

8. *Uroctea thaleri* Rheims, Santos & van Harten, 2007
=*Uroctea indica* Pocock, 1900, misident. by Gajbe & Bhadra, 1978; Gajbe, 2007
- Delhi (Malik *et al.*, 2017)
- Gujarat (Parmar, 2018)
- Maharashtra (Gajbe, 2007)
- Rajasthan (Gajbe & Bhadra, 1978; Gajbe, 2007)

Elsewhere: Iran, Israel, Turkey, Yemen.

9. *Uroctea* sp.
- Maharashtra (Nerlekar *et al.*, 2016)

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Contributions to the scorpion fauna of Iran. Part I. Records of Genus *Hottentotta* Birula, 1908 (Arachnida: Scorpiones: Buthidae)

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Abstract

New distribution records are given herein for six *Hottentotta* species in Iran. They belong to *Hottentotta jayakari* (Pocock, 1895) (Hormozgan province), *H. juliae* Kovařík, Yağmur & Fet, 2019 (Fars province), *H. navidpouri* Kovařík, Yağmur & Moradi, 2018 (Bushehr, Fars, Hormozgan, Khuzestan provinces), *H. saulcyi* (Simon, 1880) (Ilam, Kermanshah, Khuzestan, Lorestan provinces), *H. schach* (Birula, 1905) (Fars, Chaharmahal and Bakhtiari, Kohgiluyeh and Boyer Ahmad provinces) and *H. zagrosensis* Kovařík, 1997 (Khuzestan province). Among these records, Bushehr, Fars and Khuzestan records are the first for *H. navidpouri*. Prepared maps show new and old distributional localities that belong to all known species of *Hottentotta* in Iran.

Keywords: Scorpiones, *Hottentotta*, Distribution, Iran.

Introduction

Iran has a very rich fauna due to its long geological history, isolated central plains, high mountain ranges and location between Central Asia, Anatolia and Arabian Peninsula. These specialities have made Iran also a very attractive habitat for scorpion fauna.

Cokendolpher *et al.* (2019) and Barahoei *et al.* (2020) listed 68 scorpion species belonging to 3 families. Due to geographic location, 40 of these species are endemic in Iran. Besides, the genera *Iranobuthus* Kovařík, 1997 and *Polisius* Fet, Capes & Sissom, 2001 are endemic to Iran.

Iran has also a rich fauna of the genus *Hottentotta* and we can declare it here as a hotspot of *Hottentotta* in the World. The nine following species are distributed in Iran: *Hottentotta jayakari* (Pocock, 1895), *H. juliae* Kovařík, Yağmur & Fet, 2019, *H. khoozestanus* Navidpour, Kovařík, Soleglad & Fet, 2008, *H. lorestanus* Navidpour, Nayebzadeh, Soleglad, Fet, Kovařík & Kayedi, 2010, *H. navidpouri* Kovařík, Yağmur & Moradi, 2018, *H. saulcyi* (Simon, 1880), *H. schach* (Birula, 1905), *H. sistanensis* Kovařík, Yağmur & Moradi, 2018, and *H. zagrosensis* Kovařík, 1997. All species are endemic in Iran except *H. jayakari* and *H. saulcyi* (Barahoei *et al.*, 2020; Cokendolpher *et al.*, 2019; Mirshamsi *et al.*, 2011; Kovařík, 2007; Kovařík *et al.*, 2018, 2019).

This paper is the first one of a series of papers on scorpion fauna of Iran. The specimens stated in these papers have been collected by Abolfazl Akbari between 1991 and 2019 and will be published in a genus by genus order. This first paper reports distributional records of genus *Hottentotta*.

Material and Methods

The field trips were carried out between 1991 and 2019 by the first author who collected 328 specimens from 176 different localities in Chaharmahal and Bakhtiari, Fars, Ilam, Hormozgan, Kermanshah, Lorestan, Kohgiluyeh and Boyer Ahmad provinces. Scorpions were collected by hand from under the stones during the daytime. All collected material in this study is preserved in 96% alcohol and deposited in personal collection of Abolfazl Akbari and AZMM (Zoology Museum of Alaşehir Vocational School, Celal Bayar University, Manisa, Turkey). The specimens were identified by using a Leica EZ4 stereomicroscope. Identifications of the specimens were done based on the previous work of Kovařík (2007) Kovařík *et al.* (2018, 2019), and Navidpour *et al.* (2008a, 2010). Also, distribution maps are prepared in reference to the following: Zarei *et al.* (2009), Sanaei-Zadeh *et al.* (2017) for *Hottentotta jayakari*; Karataş *et al.* (2012), Navidpour *et al.* (2008a, 2012), Kovařík *et al.* (2019) for *Hottentotta juliae*; Navidpour *et al.* (2008a) for *Hottentotta khoozestanus*; Navidpour *et al.* (2010) for *Hottentotta lorestanus*; Kovařík *et al.* (2018), Barahoei *et al.* (2020) for *Hottentotta navidpouri*; Asslan-Faal *et al.* (2015), Barahoei *et al.* (2020), Dehghani *et al.* (2008), Gharakhloo *et al.* (2018), Habibi (1971), Karataş *et al.* (2012), Karataş & Gharkheloo (2006), Kovařík (1997, 2007), Kovařík *et al.* (2018, 2019), Mohammadi-Bavani *et al.* (2017), Moradi *et al.* (2015), Mozaffari *et al.* (2013), Navidpour *et al.* (2008a, 2008b, 2008c, 2008d, 2010, 2012, 2013, 2019), Nazari & Rastegar (2016), Nejati *et al.* (2014), Pirali-Kheirabadi *et al.* (2009, 2013), Shahi *et al.* (2008), Sharifinia *et al.* (2017), Simon (1880), Taherian *et al.* (2014) for *Hottentotta saulcyi*; Akbari *et al.* (2001), Habibi (1971), Karataş *et al.* (2012), Kovařík (1997), Kovařík *et al.* (2019) for *Hottentotta schach*; Kovařík *et al.* (2018), Barahoei *et al.* (2020) for *Hottentotta sistanensis*; Pirali-Kheirabadi *et al.* (2009, 2013), Barahoei *et al.* (2020), Kovařík (1997, 2007), Navidpour *et al.* (2008a, 2008d, 2010, 2012), Nazari *et al.* (2018), Moradi *et al.* (2015) for *Hottentotta zagrosensis*.

Abbreviations of collections:

BMNH = British Museum of Natural History, London, United Kingdom.
FKCP = František Kovařík, private collection, Prague, Czech Republic).
MNHN = Muséum National d´Histoire Naturelle, Paris, France.
ZISP = Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

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Figs. 1-4. *Hottentotta jayakari* (Pocock, 1895), Habitus.
1-2. ♀. 3-4. ♂. 1,3. dorsal view. 2,4. ventral view.

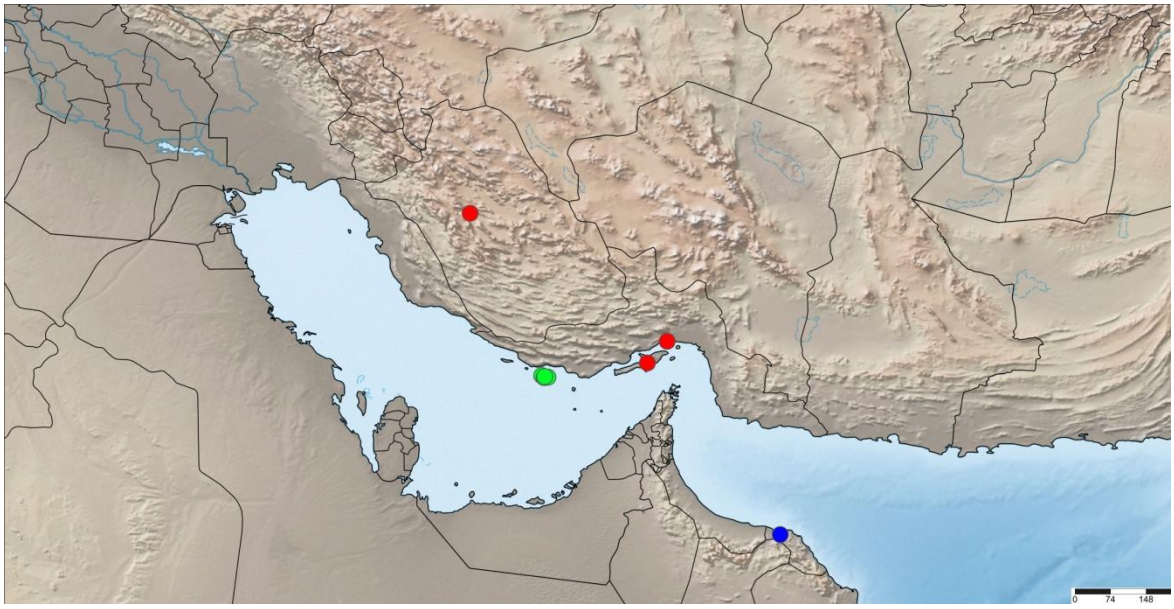

Fig. 5. Map of the distribution of *Hottentotta jayakari* (Pocock, 1895) in Iran. Blue circle: Type locality, Red circles: Literature records, Green circles: Collected in this study.

Results

Family **Buthidae** C.L. Koch, 1837
Hottentotta jayakari (Pocock, 1895)
Figs. 1-4.
Type Locality and Type Depository: Muscat, Oman; BMNH.

Synonyms:
Buthus jayakari Pocock, 1895
Buthus jayakari: Kraepelin, 1899; Werner, 1929; Werner, 1936.
Buthus (*Hottentotta*) *jayakari*: Birula, 1914a.
Buthus (*Hottentotta*) *jayakari*: Birula, 1914b; Birula, 1917.
Buthus (*Buthus*) *jayakari*: Roewer, 1943.
Buthotus jayakari: Vachon, 1949; Vachon, 1952; Vachon, 1966; Vachon & Stockmann, 1968; Pérez, 1974; Vachon, 1977; Kinzelbach, 1985; Farzanpay, 1988; Al-Safadi, 1992; El-Hennawy, 1992.
Hottentotta jayakari: Sissom, 1994; Kovařík, l 997; Kovařík, 1998.
Hottentotta jayakari jayakari: Fet & Lowe, 2000; Hendrixson, 2006.

Examined material: Hormozgan, Kish, Bago, 26°32'30"N, 53°54'50"E, 4 m, 9♀♀; Kish, Frorbozorg, 26°30'13"N, 53°57'27"E, 9 m, 1♀, 4juv.; Kish, nearly to airport in Kish, 26°31'25"N, 53°58'15"E, 28 m, 1♂.

Distribution: Iran (Werner, 1929), Oman (Pocock, 1895), Saudi Arabia (Hendrixson, 2006), United Arab Emirates (Hendrixson, 2006) and Yemen (Al-Safadi, 1992). The record from India (Kraepelin, 1901) probably incorrect identification.

Distribution in Iran: Hormozgan (Werner, 1929) and Fars (Sanaei-Zadeh *et al.*, 2017) (Fig. 5).

Comments: Werner (1929) recorded this species from Iran for the first time from Bandar Abbas (Hormozgan). Farzanpay (1988) recorded this species from Iran without a specific

locality information. But Navidpour (2012) reported it from Hormozgan province after Farzanpay (1988). Subsequently, Zarei *et al.* (2009) reported it from Qeshm Island. Recently, Sanaei-Zadeh *et al.* (2017) reported it from Shiraz (Fars) and Zamani (2016) reported it from some islands of Persian Gulf. Our record from Kish Island is coherent with records of Zarei *et al.* (2009) and Zamani (2016).

Hottentotta juliae Kovařík, Yağmur & Fet, 2019

Figs. 6-9.

Type Locality and Type Depository: Fars Province, 10 km E of Sivand Village, Iran; FKCP.

Synonyms:

Hottentotta juliae Kovařík, Yağmur & Fet, 2019

Hottentotta schach: Kovařík, 2007; Navidpour *et al.*, 2008a; Navidpour *et al.*, 2010; Karataş *et al.*, 2012; Navidpour *et al.*, 2012; Navidpour, 2012; Kovařík & Ojanguren Affilastro, 2013.

Examined material: Fars, Abadeh, Seyyedan Village, 31°08'33"N, 52°37'20"E, 2027 m, 1juv.; Estahban, Roniz Village, 29°11'26"N, 53°46'05"E, 1588 m, 1juv.; Kavar, Akbarabad, 29°14'45"N, 52°46'49"E, 1520 m, 1juv.; Marvdasht, Zargran Village, 29°45'51"N, 52°42'48"E, 1606 m, 1♀; Marvdasht, Ramjerd Village, 30°04'26"N, 52°35'35"E, 1619 m, 1juv.; Shiraz, Maharloo, 29°29'37"N, 52°54'48"E, 1669 m, 1♀; Niriz, Horgan Village, 29°06'07"N, 54°28'02"E, 1878 m, 1juv.; Saadat Shahr, Ghavam Abad Village, 29°34'44"N, 53°20'16"E, 1570 m, 2♀♀; Saadat Shahr, Sivand Village, 30°04'45"N, 52°55'15"E, 1708 m, 1♂; Sarvestan, Dehnow Village, 29°26'00"N, 52°38'00"E, 1479 m, 1♀; Sarvestan, Qasr-e Sasan Village, 29°15'45"N, 53°14'32"E, 1588 m, 1juv.

Distribution: Iran (Kovařík *et al.*, 2019).

Distribution in Iran: Fars (Karataş *et al.*, 2012; Kovařík, 2007; Kovařík *et al.*, 2019; Navidpour *et al.*, 2012) and Khuzestan (Navidpour *et al.*, 2008a) (Fig. 10).

Comments: As explained in comments of *Hottentotta schach*, *Hottentotta juliae* populations were identified as *H. schach* and this confusion was corrected by Kovařík *et al.* (2019). We confirm its distribution in Fars province. *Hottentotta juliae* was reported as *Hottentotta schach* by Karataş *et al.* (2012), Kovařík (2007) and Navidpour *et al.* (2008a, 2012). We accept these records as *Hottentotta juliae*.

Hottentotta navidpouri Kovařík, Yağmur & Moradi, 2018

Figs. 11-14.

Type Locality and Type Depository: Hormozgan Province, Lengeh, Iran; FKCP.

Synonyms:

Hottentotta navidpouri Kovařík *et al.*, 2018

Hottentotta saulcyi: Navidpour *et al.*, 2013.

Examined material: Fars, Bastak, Kozark Village, 29°28'50"N, 52°07'20"E, 2148 m, 1♀; Evaz, Kooreh Village, 28°57'22"N, 54°22'60"E, 1422 m, 2♀♀, 1juv.; Evaz, Hood Village, 27°57'35"N, 53°40'02"E, 766 m, 1♀, 1♂, 1juv.; Jahrom, Khorramabad Village, 28°28'60"N, 53°44'21"E, 1352 m, 1juv.; Qir, Kheyrabad Village, 28°26'59"N, 53°03'16"E, 715 m, 1juv.; Lamred, Roknabad Village, 29°13'24"N, 53°09'58"E, 1519 m, 1juv.; Lar, Hermoud Village, 27°30'52"N, 54°17'22"E, 719 m, 1♀; Lar, Gelar Village,

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Figs. 6-9. *Hottentotta juliae* Kovařík, Yağmur & Fet, 2019, Habitus.
6-7. ♀. 8-9. ♂. 6,8. dorsal view. 7,9. ventral view.

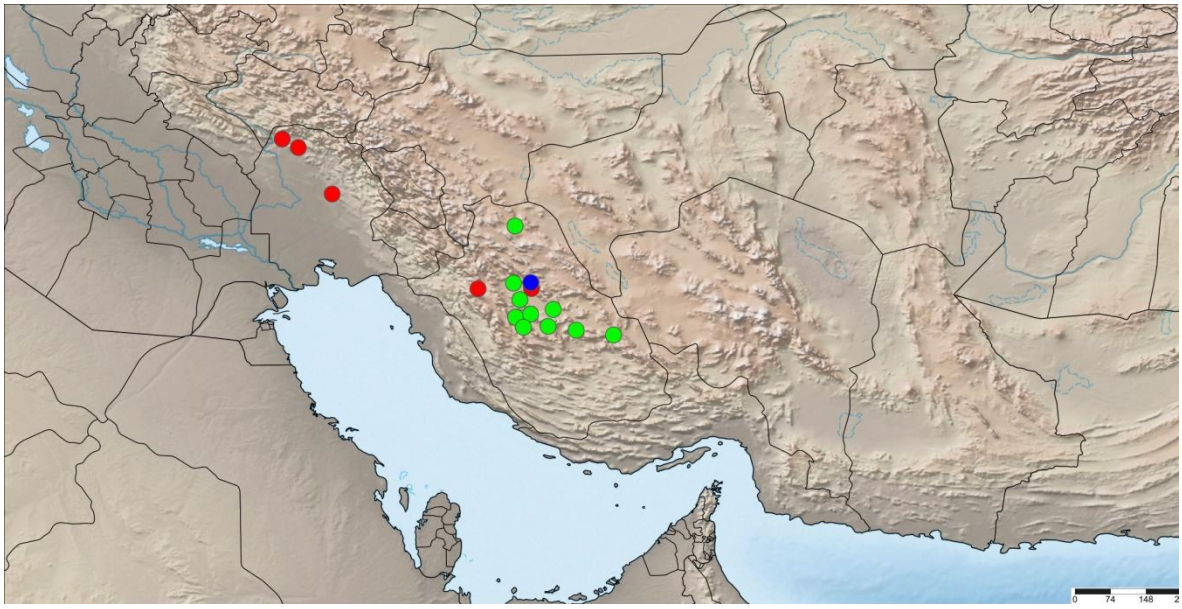

Fig. 10. Map of the distribution of *Hottentotta juliae* Kovařík, Yağmur & Fet, 2019 in Iran. Blue circle: Type locality, Red circles: Literature records, Green circles: Collected in this study.

27°52'00"N, 53°50'00"E, 888 m, 1♀; Lar, Ashknan Village, 27°13'55"N, 53°36'20"E, 393 m, 1juv.; Lar, Kohneh Village, 27°54'00"N, 54°01'08"E, 786 m, 1juv.; **Bushehr,** Asaluyeh, Bidkhoon Village, 27°28'37"N, 52°39'45"E, 21 m, 1♂; **Hormozgan,** Bandar Abbas, Tahlu Village, 27°21'00"N, 56°18'25"E, 147 m, 1♀; Bandar Abbas, Fin District, 27°37'54"N, 55°53'08"E, 313 m, 1♀; Bandar Charak, Homairan Village, 27°01'58"N, 53°41'34"E, 237 m, 1♀; Bandar Lengeh, Merakan Village, 26°45'36"N, 54°50'19"E, 24 m, 1♀; Bandar Lengeh, Bandar Kong Town, 26°36'23"N, 54°56'40"E, 6 m, 1juv.; Bandar Lengeh, Bostaneh Village, 26°30'44"N, 54°39'22"E, 12 m, 1juv.; Bandar Lengeh, Merakan Village, 26°45'36"N, 54°50'19"E, 24 m, 1juv.; Bandar Abbas, Qotbabad Village, 27°46'19"N, 56°04'31"E, 722 m, 1juv.; Bandar Abbas, Siahoo area, 27°41'54"N, 56°14'24"E, 493 m, 1juv.; Hajjiabad, Saadatabad Village, 28°03'39"N, 55°52'31"E, 691 m, 1juv.; Hajjiabad, Sang-e Siyah Village, 26°53'57"N, 55°18'44"E, 33 m, 1juv.; Hajjiabad, Fareghan Village, 28°00'22"N, 56°15'11"E, 1188 m, 1juv.; Parsian, Berkeh Doka Village, 27°16'23"N, 52°56'04"E, 35 m, 1♀; **Khuzestan,** Bagh-e Malek, Dam ab Village, 31°47′33″N 49°27′30″E, 364 m, 1♀; Bagh-e Malek, Kooreh Village, 30°20'20"N, 49°44'30"E, 10 m, 1♀; Bagh-e Malek, Qaleh Tall Town, 31°38'02"N, 49°53'07"E, 881 m, 1 juv.; Bagh-e Malek, Takyeh Village, 31°39'39"N, 49°55'25"E, 984 m, 1juv.; Haftkel, Sar Teyuk Village, 31°30'00"N, 49°36'00"E, 471 m, 1♀; Hoveyzeh, Saidiyeh, 31°42'00"N, 47°55'00"E, 8 m, 2♂; Bagh-e Malek Town, 31°31'00"N, 49°53'00"E, 684 m, 2♀; Izeh, Dehdez District, 31°44'00"N, 50°16'00"E, 1820 m, 1♀; Ramhormoz, Dasht-e Dena Village, 31°22'32"N, 49°40'47"E, 389 m, 2♂♂, 1juv.; Ramhormoz, Doblsaid Village, 31°14'00"N, 48°25'11"E, 13 m, 1♀; Ramhormoz, Mamatin Village, 31°18'29"N, 49°46'00"E, 338 m, 3♂♂, 2♀♀; Ramhormoz, Rood Zard (Kalgeh) Village, 31°30'24"N, 49°47'29"E, 573 m, 1♂, 1♀; Ramhormoz, Rood Zard Village, 31°22'04"N, 49°43'18"E, 366 m, 1♂; Haftgel, Shifeh Village, 31°22'06"N, 49°30'39"E, 102 m, 1♂.

Distribution: Iran (Kovařík *et al.*, 2018).

Distribution in Iran: Hormozgan (Kovařík *et al.*, 2018), Fars, Khuzestan (First record) (Fig. 15).

Comments: This species was recently described by Kovařík *et al.* (2018) from Hormozgan. We recorded neighbouring provinces Bushehr, Fars, and Khuzestan for the first time and confirm its distribution in Hormozgan.

Hottentotta saulcyi (Simon, 1880)

Figs. 16-19.

Type Locality and Type Depository: Mosul, Iraq; MNHN.

Synonyms:

Hottentotta juliae Kovařík, Yağmur & Fet, 2019

Hottentotta schach: Kovařík, 2007; Navidpour *et al.*, 2008a; Navidpour *et al.*, 2010; Karataş *et al.*, 2012; Navidpour *et al.*, 2012; Navidpour, 2012; Kovařík & Ojanguren Affilastro, 2013.

Examined material: Lorestan, Aleshtar, Cheshmeh Barqi Village, 33°51'52"N, 48°17'00"E, 1626 m, 3♀; Aleshtar, Firouz Abad Village, 1♂, 33°53'47"N, 48°06'06"E, 1702 m, 1juv.; Aleshtar, Kaka Reza Village, 33°42'50"N, 48°16'20"E, 1557 m, 1♂, 2♀♀, 1juv.; Aligudarz, Borm Village, 33°15'09"N, 49°40'28"E, 2099 m, 2♂♂, 1juv.; Aligudarz, Khak Beh Tiyeh Village, 33°07'23"N, 49°39'07"E, 2128 m, 2♂♂; Aligudarz, Malekabad Village, 33°16'34"N, 49°35'04"E, 2155 m, 1♂, 1♀; Aligudarz, Savar Village, 33°24'03"N, 49°36'32"E, 1919 m, 1♀; Azna, Darreh Takht Village, 33°22'26"N, 49°22'58"E, 1863 m, 2♀♀; Azna, Tian Village, 33°25'05"N, 49°17'07"E, 1799 m, 1juv.; Borujerd, Chalan Chulan Village, 33°39'22"N, 48°54'10"E, 1476 m, 2♀♀, 1juv.; Borujerd, Dinarabad Village, 33°43'00"N, 48°47'00"E, 1556 m, 1♀, 1juv.; Dorud, Amirabad Village, 33°34'21"N, 49°00'17"E, 1458 m, 2♀♀; Dorud, Lanjabad Village, 33°26'34"N, 49°00'43"E, 1466 m, 3juv.; Khorramabad, Ahmadabad Village, 33°25'10"N, 48°37'14"E, 1661 m, 1♂, 1♀; Khorramabad, Badeh Village, 33°28'25"N, 48°35'52"E, 1727 m, 1juv.; Khorramabad, Chele Khaneh Village, 34°07'33"N, 47°29'31"E, 1422 m, 4♀♀, 1♂; Khorramabad, Chenar Khoshkeh Village, 33°21'26"N, 48°30'52"E, 1463 m, 2juv.; Khorramabad, Cheshmeh Sorkheh Village, 33°23'38"N, 48°19'31"E, 1207 m, 2juv.; Khorramabad, Ghaleh Gol Area, 33°15'40"N, 48°31'43"E, 2046 m, 3juv.; Khorramabad, Imanabad Village, 33°23'10"N, 48°36'16"E, 1625 m, 1♂; Khorramabad, Namaklan Village, 33°28'08"N, 48°26'30"E, 1306 m, 2♂♂, 1♀; Khorramabad, Nojian Village, 33°13'47"N, 48°34'30"E, 1329 m, 2juv.; Khorramabad, Zagheh Village, 33°30'11"N, 48°42'05"E, 1805 m, 2♂♂, 5♀♀; Kuhdasht, Chenar Village, 33°20'30"N, 48°54'33"E, 1443 m, 1juv.; Kuhdasht, Ganjineh Village, 33°24'04"N, 47°38'54"E,1204 m, 1juv.; Kuhdasht, Hashem Beg Village, 33°26'10"N, 47°29'25"E, 1303 m, 1♂, 1juv.; Kuhdasht, Kunani Village, 33°24'08"N, 47°21'47"E, 1068 m, 1juv.; Pol-e Dokhtar, Baba Bahram Village, 33°14'25"N, 47°53'15"E, 985 m, 1♀; Pol-e Dokhtar, Malavi Village, 33°15'48"N, 47°45'44"E, 712 m, 3♂♂, 1♀; Pol-e Dokhtar, Meydan-e Bozorg Village, 33°10′41″N, 47°31′18″E, 827 m, 2♂♂; Pol-e Dokhtar, Sarab Hammam Village, 33°06'35"N, 47°41'36"E, 692 m, 2♀♀; **Kermanshah,** Central, Berenjan Village, 34°39'49"N, 46°54'30"E, 1348 m, 1juv.; Central, Chalab Village, 34°06'38"N, 47°13'02"E, 1657 m, 2juv.; Central, Gakiyeh Village, 34°19'11"N, 47°13'06"E, 1335 m, 1♂; Central, Robat Village, 34°16'03"N, 46°48'25"E, 1354 m, 2♂♂, 2juv.; Eslamabad-e Gharb, Hasanabad Village, 34°38'07"N, 47°11'37"E, 1564 m, 6juv.; Gilan-e Gharb, Kal Kash Village, 34°07'42"N, 46°10'28"E, 1155 m, 2juv.; Gilan-e Gharb, Kaseh Garan Village, 34°05'24"N, 46°01'47"E, 1023 m, 1♂; Hersin, Elyasvand Village, 34°16'15"N,

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Figs. 11-14. *Hottentotta navidpouri* Kovařík, Yağmur & Moradi, 2018, Habitus. 11-12. ♀. 13-14. ♂. 11,13. dorsal view. 12,14. ventral view.

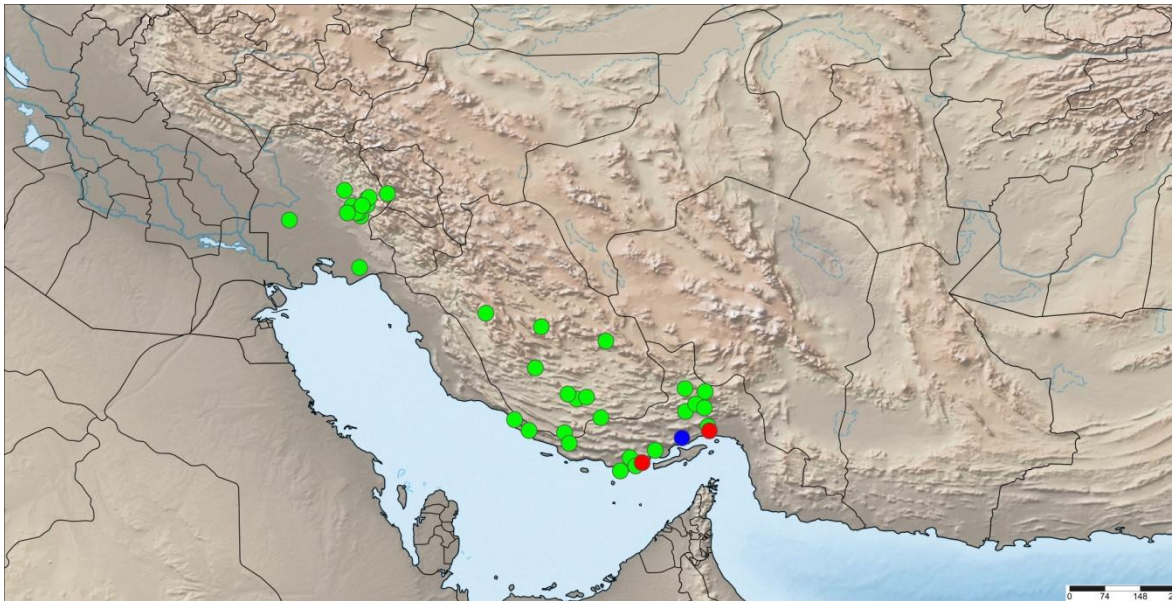

Fig. 15. Map of the distribution of *Hottentotta navidpouri* Kovařík, Yağmur & Moradi, 2018 in Iran. Blue circle: Type locality, Red circles: Literature records, Green circles: Collected in this study.

47°28'23"E, 1358 m, 2juv.; Islamabad-e Garb, Kaseh Garan Village, 34°05'34"N, 46°01'12"E, 1030 m, 1juv.; Javansar Town, 34°48'38"N, 46°29'12"E, 1375 m, 1juv.; Paveh, Kama Darreh Village, 35°06'24"N, 46°18'05"E, 1080 m, 2 1juv.; Ravansar, Shahgodar (Kani Sharif) Village, 34°33'10"N, 46°46'58"E, 1318 m, 2♀♀, 1juv.; Sarpol-e Zahab, Rijab Village, 34°28'44"N, 45°59'59"E, 1016 m, 1♂, 1juv.; Sarpol-e Zahab, Baba Yadegar Village, 34°35'59"N, 45°59'00"E, 1043 m, 1juv.; Sonqor, Charghalan Village, 34°49'11"N, 47°25'16"E, 1898 m, 1♀; **Ilam,** Abdanan, Anjireh Village, 33°04'48"N, 47°11'27"E, 1323 m, 2♂♂; Abdanan, Gandab Village, 33°03'03"N, 47°15'44"E, 1235 m, 2♀♀; Abdanan, Haft Cheshmeh Village, 32°58'01"N, 47°26'56"E, 845 m, 1juv.; Central, Baraftab Village, 33°43'00"N, 46°42'20"E, 993 m, 1juv.; Central, Cheshmeh Kabud Village, 33°34'00"N, 46°25'10"E, 1321 m, 1juv.; Central, Jafarabad Village, 33°30'15"N, 46°32'18"E, 1237 m, 1juv.; Central, Khoran Olia Village, 33°49'26"N, 46°14'48"E, 1208 m, 2juv.; Central, Qalandar Village, 33°38'40"N, 46°38'22"E, 1053 m, 2juv.; Central, Nakhjir Area, 33°31'60"N, 46°19'00"E, 1783 m, 2juv.; Darreh Shahr, Abbasabad Village, 33°13'31"N, 47°15'07"E, 646 m, 2juv.; Darreh Shahr, Armu Village, 33°06'34"N, 47°28'29"E, 598 m, 1♀, 1♂; Darreh Shahr, Bedreh town, 33°18'16"N, 47°02'11"E, 1055 m, 5juv.; Darreh Shahr, Bon Baba Jan Village, 33°04'11"N, 47°32'49"E, 612 m, 2juv.; Darrehshahr, Haji Hazer Village, 33°54'11"N, 46°12'57"E, 1092 m, 1♂, 1juv.; Darreh Shahr, Kalam Village, 33°53'22"N, 46°12'30"E, 1068 m, 1♂, 1♀; Darrehshahr, Kal Sefid Village, 33°04'52"N, 47°31'00"E, 661m, 1♀; Darreh Shahr, Kolm-e Bala Village, 33°21'27"N, 46°54'47"E, 628 m, 1♀, 1juv.; Darreh Shahr, Sartang Village, 33°38'37"N, 46°40'41"E, 1014 m, 1juv.; Darreh Shahr, Soltanabad Village, 33°40'00"N, 46°17'01"E, 1183 m, 2juv.; Dehloran, Mimeh (Zarin Abad) Village, 33°00'07"N, 46°56'23"E, 678 m, 2♀♀, 2juv.; Dehloran, Mormori Village, 32°43'35"N 47°40'39"E, 502 m, 2♀♀, 1juv.; Dehloran, Mousian Village, 32°31'00"N, 47°22'00"E, 151 m, 1♀; Dehloran, Shafi khan Village, 33°51'00"N, 46°33'24"E, 1555 m, 1juv.; Dehloran, Zarrinabad olya Village, 33°05'00"N, 47°00'04"E, 940 m, 1juv.; Eyvan, Chalanchi Village, 33°48'18"N, 46°19'41"E, 1230 m, 1♂, 1juv.; Eyvan, Chaga Village, 33°43'50"N, 46°11'42"E, 657 m, 2juv.; Eyvan, Chovar Village, 33°41'45"N, 46°17'56"E, 1042 m, 2♀♀; Eyvan, Sarab

Village, 33°45'22"N, 46°21'49"E, 1291 m, 2♀♀; Eyvan, Khoran Village, 33°49'26"N, 46°14'48"E, 1202 m, 1♂; Eyvan, Zalan Village, 33°45'00"N, 46°21'00"E, 1554 m, 1juv.; Eyvan, Zarneh Village, 33°55'39"N, 46°11'02"E, 1076 m, 3juv.; Chovar, Murt Village, 33°41'45"N, 46°17'56"E, 1041 m, 1♀; Sarableh, Ali Madad Village, 33°50'00"N, 46°29'04"E, 1221 m, 2juv.; Srableh, Cheshme Rashid Village, 33°43'55"N, 46°31'51"E, 1274 m, 1♀; Srableh, Kalan Village, 33°53'22"N, 46°12'30"E, 1070 m, 1♂; **Khuzestan,** Andimeshk, Bidrubeh Village, 32°45'35"N, 48°14'15"E, 441 m, 2♀♀; Andimeshk, Hoseyniye Village, 32°37'57"N, 48°17'07"E, 289 m, 1♂, 3♀♀; Andimeshk, Kakro Village, 32°49'00"N, 48°28'00"E, 584 m, 2♀♀; Andimeshk, Mahmudabad Village, 32°05'00"N, 49°29'00"E, 614 m, 2♂♂; Andimeshk, Mazu Village, 32°47'20"N, 48°30'28"E, 440 m, 2♀♀, 1juv.; Andimeshk, Shahyan Area, 32°32'60"N, 48°28'60"E, 392 m, 1♂, 1♀; Andimeshk, Sorkh Kan Village, 32°45'35"N, 48°17'59"E, 522 m, 1♂; Andimeshk, Sorkh Kan Village, 32°46'46"N, 48°19'12"E, 476 m, 1♀; Masjed Soleyman, Chelpalangi Village, 32°16'00"N, 49°03'00"E, 126 m, 1♀.

Distribution: Afghanistan (Kovařík, 1997), Iraq (Simon, 1880), Iran (Vachon, 1966), Turkey (Crucitti & Vignoli, 2002).

Distribution in Iran: East Azerbaijan, Esfahan, Kurdistan, Tehran (Habibi, 1971); Bushehr, Khuzestan (Akbari *et al.*, 1997); Hamadan, Lorestan (Kovařík, 1997); North Khorasan, (Karataş & Gharkheloo, 2006); Kermanshah, Fars, Ilam (Kovařík, 2007); Hormozgan (Shahi *et al.*, 2008); Kerman (Dehghani *et al.*, 2008); Kohgilouyeh & Boyer Ahmad (Navidpour *et al.*, 2008d); Chahar Machal & Bakhtiyari (Pirali-Kheirabadi *et al.*, 2009); Sistan and Baluchistan (Nejati *et al.*, 2014); Qazvin, Mazandaran (Karataş *et al.*, 2012), Zanjan (Moradi *et al.*, 2015), Alborz, Markazi (Navidpour *et al.*, 2019) and West Azerbaijan (Gharakhloo *et al.*, 2018) (Fig. 20).

Comments: *Hottentotta saulcyi* is a widespread species in Iran. We confirm its distribution herein in Ilam, Kermanshah, Khuzestan, and Lorestan Provinces.

Hottentotta schach (Birula, 1905)

Figs. 21-24.

Type Locality and Type Depository: Khoozestan Province, Dech-i-Dis (now Dehdez), Iran; ZISP.

Synonyms:
Buthus schach Birula, 1905
Buthus (Hottentotta) schach: Birula, 1917.
Hottentotta (Hottentotta) schach: Kovařík, 1998; Fet & Lowe, 2000.
Hottentotta schach: Kovařík *et al.*, 2019.

Examined material: Fars, Kazerun, Alivand Village, 30°04'00"N, 52°32'00"E, 1607 m, 2juv.; Kazerun, Begdeli Village, 29°51'59"N, 51°21'59"E, 887 m, 2juv.; Kazerun, Qaemyeh Village, 29°47'25"N, 51°34'23"E, 819 m, 3♀♀, 2juv.; Kazerun, Kamaraj Village, 29°36'37"N, 51°28'36"E, 853 m, 2♀♀, 2juv.; Kazerun, Konartakhte Village, 29°32'03"N, 51°23'39"E, 507 m, 1♀, 1juv.; Kazerun, Khesht Village, 29°33'54"N, 51°20'02"E, 486 m, 2juv.; Kazerun, Emarat Village, 29°39'30"N, 51°22'41"E, 686 m, 3juv.; Noor Abad, Ahangari Village, 30°07'04"N, 51°26'21"E, 901 m, 2juv.; Noor Abad, Baba Monir Village, 30°04'13"N, 51°12'15"E, 1030 m, 1♀, 3juv.; Noor Abad, Pol-e Fahlian Town, 30°11'25"N, 51°29'13"E, 902 m, 1juv.; Noor Abad, Robat Village, 30°03'18"N, 51°17'08"E, 1176 m, 2juv.; **Chaharmahal and Bakhtiari,** Ardal, Bajgiran

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Figs. 16-19. *Hottentotta saulcyi* (Simon, 1880), Habitus.
16-17. ♀. 18-19. ♂. 16,18. dorsal view. 17,19. ventral view.

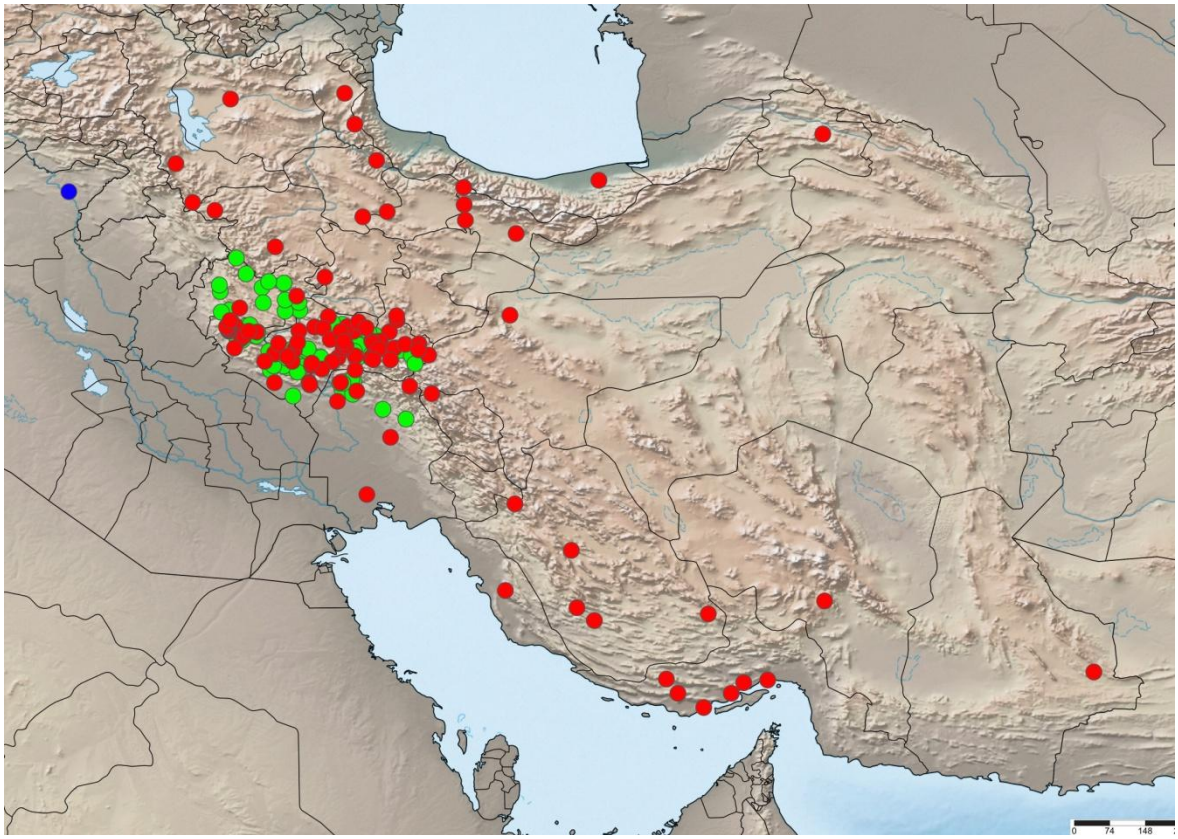

Fig. 20. Map of the distribution of *Hottentotta saulcyi* (Simon, 1880) in Iran. Blue circle: Type locality, Red circles: Literature records, Green circles: Collected in this study.

Village, 31°55'05"N, 50°40'21"E, 1944 m, 2♂♂; Ardal, Dalan Village, 31°19'25"N, 49°52'15"E, 503 m, 2♂♂; Ardal, Gol Sefid Village, 31°54'07"N, 50°36'32"E, 1593 m, 1♀; Ardal, Kaj Village, 32°03'25"N, 50°34'57"E, 1696 m, 1juv.; Ardal, Naghan Town, 31°55'55"N, 50°43'32"E, 1994 m, 1♀; Ardal, Rostamabad Village, 32°05'22"N, 50°32'47"E, 1855 m, 1juv.; Ardal, Sarkhun Village, 31°58'52"N, 50°41'13"E, 1942 m, 1♀; Borujen, Aqbolagh Village, 31°54'22"N, 51°07'22"E, 2237 m, 1juv.; Borujen, Boldaji Village, 31°56'15"N, 51°03'05"E, 2253 m, 1juv.; Borujen, Gandoman Village, 31°51'52"N, 51°09'21"E, 2242 m, 1♀, 1juv.; **Kohgiluyeh and Boyer Ahmad,** Dehdasht, Baraftab Village, 30°50'30"N, 51°14'13"E, 1931 m, 1♂, 1juv.; Sisakht, Dehnow Village, 30°17'24"N, 51°24'49"E, 843 m, 2♀♀, 1juv.; Sisakht, Grabsolfa Village, 30°56'05"N, 50°53'22"E, 1625 m, 1♀; Sisakht, Maregoon Village, 30°30'24"N, 51°54'00"E, 2159 m, 1♀; Sisakht, Totnedeh Village, 30°53'02"N, 51°20'25"E, 1721 m, 1juv.; Yasuj, Chitab Village, 30°47'41"N, 51°19'30"E, 1654 m, 1juv.; Yasuj, Dashtrom Village, 32°25'03"N, 51°43'57"E, 1655 m, 1♀; Yasuj, Madavan Village, 30°43'13"N, 51°32'38"E, 1853 m, 1♂.

Distribution: Iran (Birula, 1905).

Distribution in Iran: Khuzestan (Birula, 1905); Chaharmahal and Bakhtiyari, Kohgilouyeh and Boyer Ahmad (Akbari *et al.*, 2001); Esfahan (Habibi, 1971); Fars (Kovařík, 1997) (Fig. 25).

Comments: *H. schach* is very similar species to another Iranian species *H. zagrosensis*. Kovařík (2007) incorrectly identified another Iranian species *H. juliae* as *H. schach* and the species *H. schach* identified and published as *H. zagrosensis*. Kovařík *et al.* (2019) corrected this confusion and described *H. juliae* as separate new species. Some *H.*

zagrosensis records were given from Kohgilouyeh & Boyer Ahmad, Chahar Mahal & Bakhtiyari, Lorestan and Zanjan Provinces until Kovařík *et al.* (2019) (Navidpour *et al.*, 2008b, 2010, 2012; Pirali-Kheirabadi *et al.*, 2009; Moradi *et al.*, 2015). These records need reviewing but Kovařík *et al.* (2019) reported that both *H. schach* and *H. zagrosensis* are distributed in Khoozestan. But it is reported herein from Lorestan, Chaharmahal and Bakhtiari and Kohgiluyeh and Boyer Ahmad. Besides, Zanjan record is reviewed herein and confirmed as *H. zagrosensis*. Recently Salari & Sampour (2018) recorded *Hottentotta schach* but the specimen has black chela and long fingers therefore we consider that this species is *Hottentotta sistanensis*. Very recently, Kassiri *et al.* (2020) recorded this species from Isfahan province.

Hottentotta zagrosensis Kovařík, 1997

Figs. 26-29.

Type Locality and Type Depository: Abshar Village, Fars Province, Iran; FKCP.

Synonyms:
Hottentotta zagrosensis Kovařík, 1997
Hottentotta zagrosensis: Kovarik, 1998.
Hottentotta zagrosensis: Kovařík *et al.*, 2019.

Examined material: Khuzestan, Bagh-e Malek, Kooreh Village, 30°20'20"N, 49°44'30"E, 10 m, 1♀; Hoveyzeh, Saidiyeh Village, 31°42'00"N, 47°55'00"E, 7 m, 1♀; Izeh, Dehdez Village, 31°42'04"N, 50°17'40"E, 1485 m, 2♂, 1♀; Izeh, Deh Kian Village, 31°43'36"N, 50°14'21"E, 1301 m, 1♀, 1juv.; Izeh, Morvarid Village, 31°43'53N, 50°22'56"E, 1748 m, 1♀; Izeh, Kolatri Village, 31°51'20"N, 49°51'21"E, 830 m, 2juv.; Masjed Soleyman, Chojeh Area, 32°34'20"N, 49°05'00"E, 853 m, 1juv.

Distribution: Iran (Kovařík, 1997).

Distribution in Iran: Fars, Kohgilouyeh and Boyer Ahmad, Lorestan (Kovařík, 1997); Khoozestan (Kovařík *et al.*, 2019); Chaharmahal and Bakhtiyari (Pirali-Kheirabadi *et al.*, 2009); Zanjan (Moradi *et al.*, 2015) (Fig. 30).

Comments: As explained above, some of *H. schach* were identified as *H. zagrosensis*. But *H. zagrosensis* records from Kohgilouyeh & Boyer Ahmad, Chahar Mahal & Bakhtiyari and Lorestan need reviewing.

Discussion

Iran has 9 species of *Hottentotta* (*H. jayakari, H. juliae, H. khoozestanus, H. lorestanus, H. navidpouri, H. saulcyi, H. schach, H. sistanensis,* and *H. zagrosensis*) and 7 of them are endemic in Iran (Mirshamsi *et al.*, 2011; Kovařík, 2007; Kovařík *et al.*, 2018, 2019). We examined *Hottentotta* species of Chaharmahal and Bakhtiari, Fars, Ilam, Hormozgan, Kermanshah, Lorestan, Kohgiluyeh and Boyer Ahmad provinces. As a result, we reported many new locality records belonging to 6 species. In addition, we confirmed the locality of the following: *Hottentotta jayakari* from Hormozgan; *H. juliae* from Fars; *H. navidpouri* from Bushehr, Fars, Hormozgan, Khuzestan; *H. saulcyi* from Ilam, Kermanshah, Khuzestan, Lorestan; *H. schach* from Fars, Chaharmahal and Bakhtiari, Kohgiluyeh and Boyer Ahmad, and *H. zagrosensis* from Khuzestan. Among these records, Bushehr, Fars and Khuzestan records are the first for *H. navidpouri*.

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Figs. 21-24. *Hottentotta schach* (Birula, 1905), Habitus.
21-22. ♀. 23-24. ♂. 21,23. dorsal view. 22,24. ventral view.

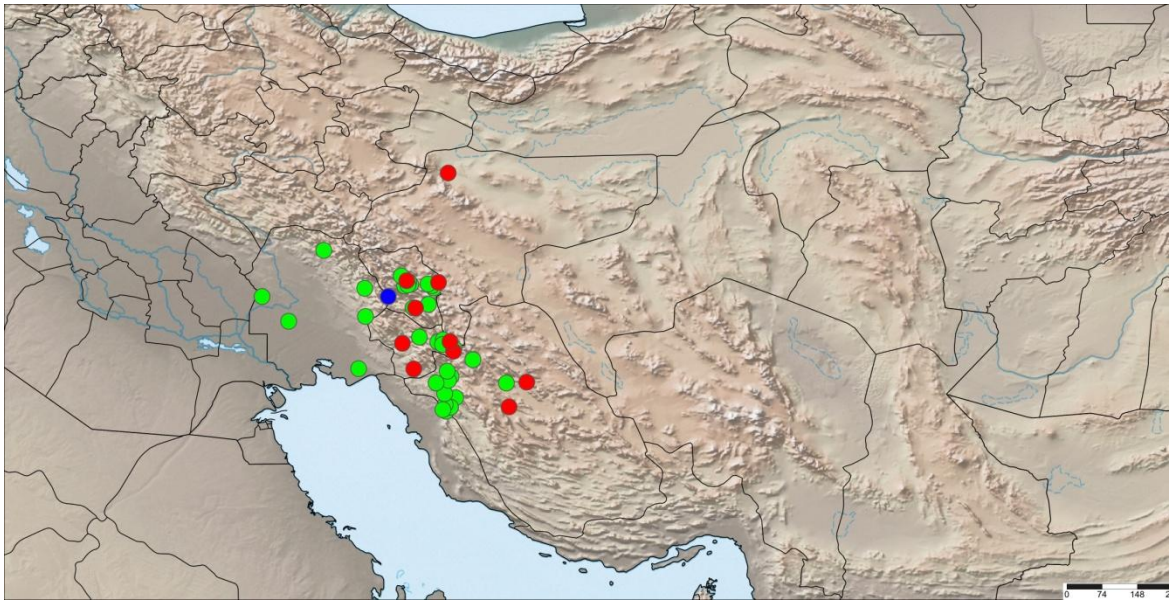

Fig. 25. Map of the distribution of *Hottentotta schach* (Birula, 1905) in Iran. Blue circle: Type locality, Red circles: Literature records, Green circles: Collected in this study.

Our results revealed that *Hottentotta juliae*, which is newly described, is widespread in Fars province. Besides, another newly described species *H. navidpouri* is widespread in Fars, Hormozgan, and south of Khuzestan whereas *H. saulcyi* is abundant in Ilam, Kermanshah, Lorestan and north of Khuzestan. More, we observed that these two species are distributed as allopatric. *H. navidpouri* prefers lowlands whereas *H. saulcyi* prefers high altitudes. Although there are previous records from Hormozgan, Kerman, Kohgilouyeh & Boyer Ahmad, Chahar Machal & Bakhtiyari, we could not confirm *H. saulcyi* presence in these provinces. The record of *H. saulcyi* by Nejati *et al.* (2014) from Sistan and Baluchistan seems doubtful.

Furthermore, Navidpour *et al.* (2012, 2013) did not report *Hottentotta jayakari* from Hormozgan and Fars and Barahoei *et al.* (2020), consider existence of *Hottentotta jayakari* doubtful in Iran. Zarei *et al.* (2009) and Sanaei-Zadeh *et al.* (2017) reported it from Hormozgan and Fars respectively. We also confirm *H. jayakari* from Kish island (Hormozgan).

Finally, *Hottentotta khoozestanus* and *H. lorestanus* are known only from their type localities in south-western Iran and *H. sistanensis* is known in a few localities in south-eastern Iran (Fig. 31). We could not detect these three species in this study.

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Figs. 26-29. *Hottentotta zagrosensis* Kovařík, 1997, Habitus.
26-27. ♀. 28-29. ♂. 26,28. dorsal view. 27,29. ventral view.

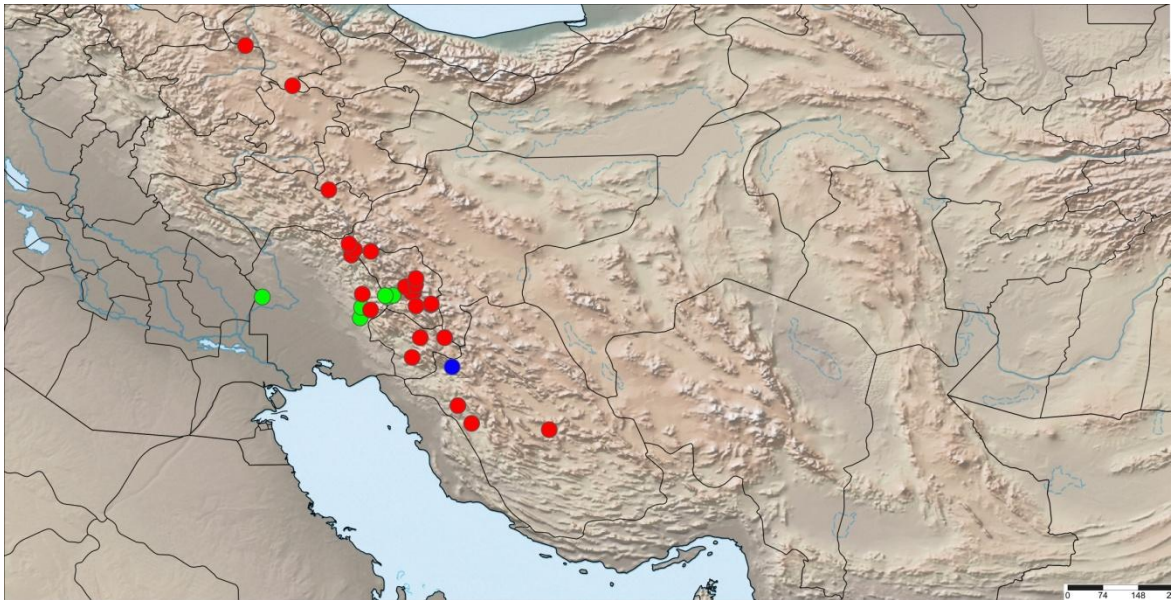

Fig. 30. Map of the distribution of *Hottentotta zagrosensis* Kovařík, 1997 in Iran. Blue circle: Type locality, Red circles: Literature records, Green circles: Collected in this study.

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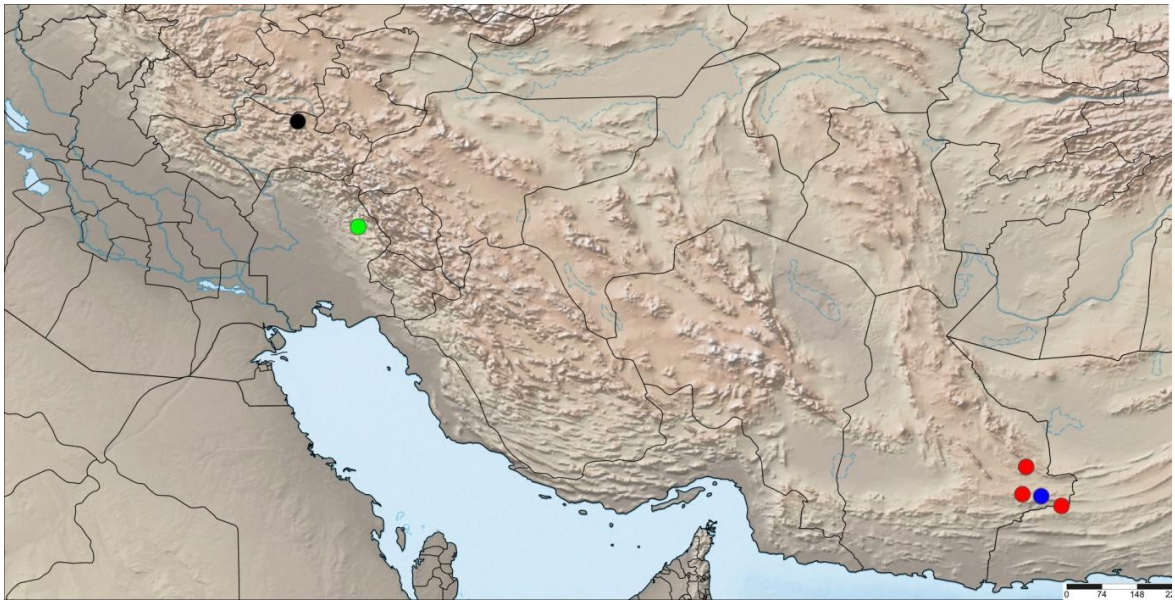

Fig. 31. Map of the distribution of *Hottentotta khoozestanus* Navidpour, Kovařík, Soleglad & Fet, 2008 [Green circle: Type locality], *Hottentotta lorestanus* Navidpour, Nayebzadeh, Soleglad, Fet, Kovařík & Kayedi, 2010 [Black circle: Type locality] and *Hottentotta sistanensis* Kovařík, Yağmur, Moradi, 2018 [Blue circle: Type locality, Red circles: Literature records] in Iran.

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The first record of *Zelotes tragicus* (O. Pickard-Cambridge, 1872) (Araneae: Gnaphosidae) in Egypt

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Abstract

The gnaphosid spider species *Zelotes tragicus* (O. Pickard-Cambridge, 1872) is recorded for the first time from Egypt. Its general habitus and genitalia are illustrated. Description and collecting data of this species are also given.

Keywords: Araneae, Gnaphosidae, *Zelotes tragicus*, new record, Egypt.

Introduction

Among the 162 genera of family Gnaphosidae Pocock, 1898 (2547 species), genus *Zelotes* Gistel, 1848 (393 species) is the largest gnaphosid genus (World Spider Catalog, 2020). Family Gnaphosidae is represented in the Egyptian fauna by 50 species of 23 genera; it is the second big family of spiders in Egypt after Salticidae [74 species of 33 genera] and before Lycosidae [44 species of 18 genera] (El-Hennawy, 2017).

Genus *Zelotes* is represented in Egypt by 5 species:

Zelotes fagei Denis, 1955 --- southern Sinai

Zelotes laetus (O. Pickard-Cambridge, 1872) --- Alexandria, Assiut, Badr district, Cairo, Elba Prot., El-Fayum, Lower Egypt

Zelotes listeri (Audouin, 1825) --- southern Sinai *

Zelotes scrutatus (O. Pickard-Cambridge, 1872) --- Alexandria, Siwa Oasis *

Zelotes tenuis (L. Koch, 1866) --- Alexandria, El-Menoufeia, Sadat City

Here, we present the new record of *Zelotes tragicus* (O. Pickard-Cambridge, 1872) from Serabium region, Ismailia governorate, Egypt.

Material and Methods

The study area, Serabium forest, about 16 km south of Ismailia, was established in 1998 and its cultivation process began in 2002 with 16 introduced tree species over nearly 600 feddans (Fig. 1). All productive trees were cultivated as patches of monoculture canopies. It is a part of the national Egyptian programme for safe use of treated sewage water for afforestation project to develop an innovative afforestation approach using water unsuitable for human direct or indirect consumption on unproductive land (Medany, 2013).

These tree canopies with their accumulated litter attracted insects and their predators of spiders and other arthropods. Hence, spiders were studied in woody forest plantation in Serabium region, Ismailia governorate, as bioindicator for environmental risk assessment by Doaa Medany (2013). The study that included 3217 individuals of 106 spider species that belong to 58 genera and 26 families, collected from only six canopy species.

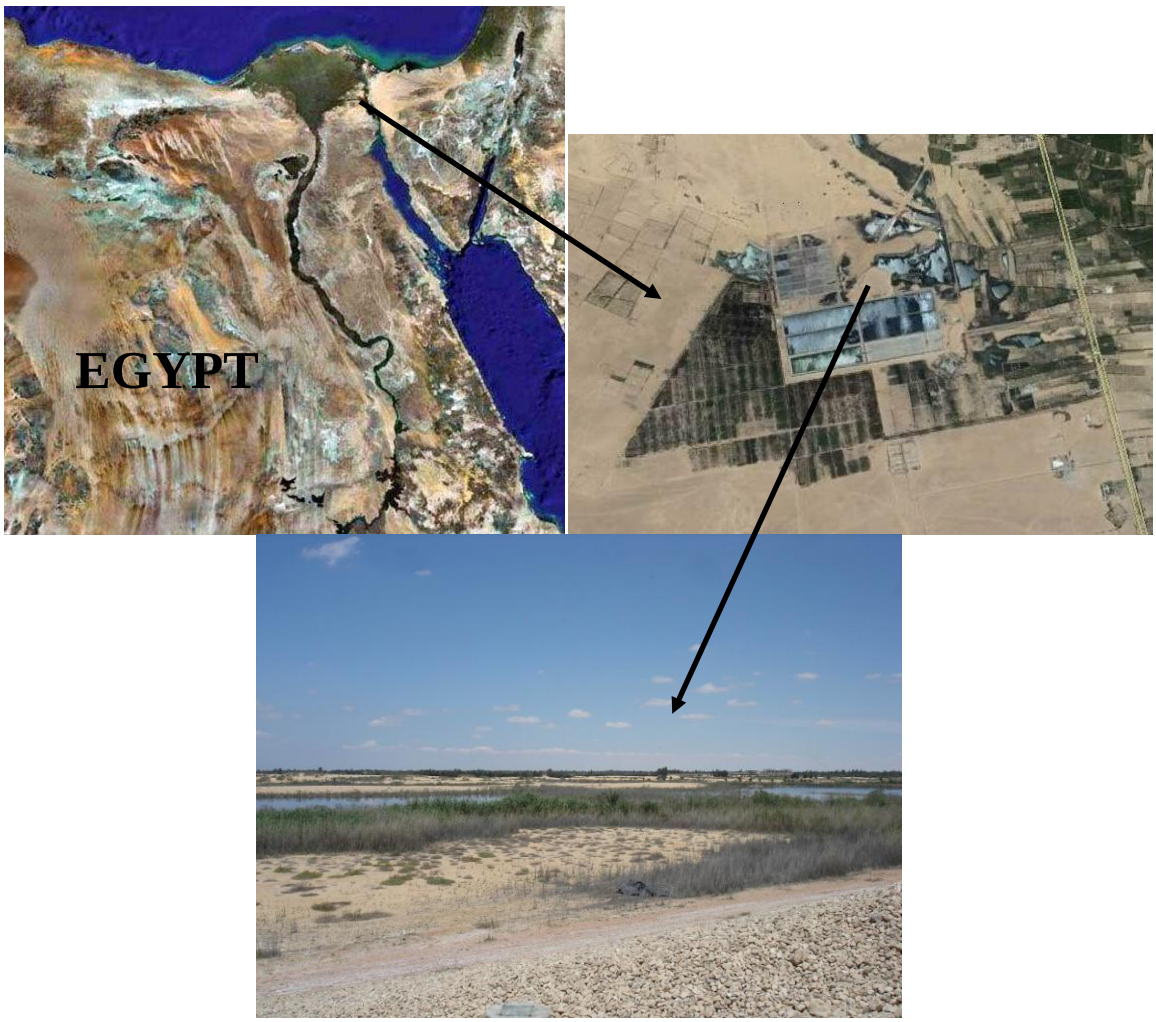


Fig. 1. Collecting site in Serabium region beside the sewage treatment station of Ismailia, Egypt.

The most species-rich family was Gnaphosidae (17 species) that was the most abundant and diverse family in the forest habitat too. During this study, five spider species were newly recorded in Egypt (Medany, 2013; El-Hennawy *et al.*, 2012; El-

Hennawy, 2017), two of them are gnaphosids: *Micaria dives* (Lucas, 1846) and *Odontodrassus aravaensis* Levy, 1999. Hence, Serabium forest looks promising to look for spiders among its trees.

In this new study, only the areas of four trees were visited:

1- *Corymbia citriodora* (Hooker, 1848) Hill & Johnson, 1995 commonly known as lemon-scented gum or spotted gum [كافور ليمونى] (Fig. 2B).

2- *Eucalyptus camaldulensis*, Dehnhardt, 1832 commonly known as the river red gum [كافور بلدى] (Fig. 2A).

3- *Khaya senegalensis* (Desr.) A. Juss. Common names include African mahogany and khaya wood [كايا].

4- *Cupressus sempervirens* L. Common names include the Mediterranean cypress [سرو].

A

A

B

Fig. 2. Trees cultivated in Serabium region near the sewage treatment station of Ismailia. A. Common *Eucalyptus camaldulensis*. B. Lemon-scented gum *Corymbia citriodora*.

Collecting spiders was done mostly by hand (Hand collecting) and sometimes by pitfall traps (Pitfall trapping), once a month, during the period from January to October 2019, preceded by two preliminary trips in July and September 2018. Pitfall traps were only used in March and April 2019.

Abbreviations used: AL = abdomen length; CL = cephalothorax length; CW = cephalothorax width; TL = total length. HECO = Hope Entomological Collections, Oxford [= Oxford University Museum of Natural History, Oxford, United Kingdom. All measurements were taken in millimetres.

Results

Among the spiders collected from Serabium forest near the sewage treatment station of Ismailia during monthly trips from January to October 2019, spiders of different genera of family Gnaphosidae were well represented. *Zelotes* spiders were found in litter below and among the trees of *C. citriodora*, *E. camaldulensis*, *K. senegalensis*, and *C. sempervirens*. *Zelotes tragicus* (O. Pickard-Cambridge, 1872) was represented by 247 individuals. The identification of juveniles is not exact, the reason that we here record the number of adults only, 26♂♂ + 38♀♀ (Table 1).

Table 1. *Zelotes tragicus* (O. Pickard-Cambridge, 1872) monthly collected adults in 2019 from Serabium forest, Ismailia governorate, Egypt.

Tree	*Corymbia citriodora*			*Eucalyptus camaldulensis*			*Khaya senegalensis*			*Cupressus sempervirens*		
Date (2019)	♂	♀	T	♂	♀	T	♂	♀	T	♂	♀	T
13/ 1					4	4						
17/ 2	8	10	18									
24/ 3	4	6	10		2	2						
13/ 4		3	3	1	1	2	1		1			
1/ 5		1	1									
23/ 6	1	1	2		1	1	2	1	3		1	1
30/ 7					2	2	1		1			
25/ 8				1		1					1	1
17/ 9	2	2	4							1		1
22/10	2	1	3		1	1				2		2
Total 64 26♂♂ + 38♀♀	17	24	41	2	11	13	4	1	5	3	2	5

N. Pitfall traps only used in 24/3/2019 [2♀ + 5j =7] & 13/4/2019 [2♀ + 1j =3].

It is evident that *Zelotes tragicus* is well represented in the area of *Corymbia citriodor* trees more than other areas folowed by the area of *Eucalyptus camaldulensi* trees. Also, the highest numbers of individuals were in February-March. This agrees Levy (1998) who said that: "The few adult females were taken in February and March, and the single male collected so far was found in March under a stone by O.P.-Cambridge (1872: 243)" [O. Pickard-Cambridge (1872: 212) said at the beginning of his paper: "The following list and descriptions have been prepared from a collection of Araneidea made by myself during a two-months' ride through the Holy Land, between the 16th of March and the 18th of May 1865."].

Family **Gnaphosidae** Pocock, 1898
Genus ***Zelotes*** Gistel, 1848

Zelotes tragicus (O. Pickard-Cambridge, 1872)
(Figs. 3-22, Table 1)

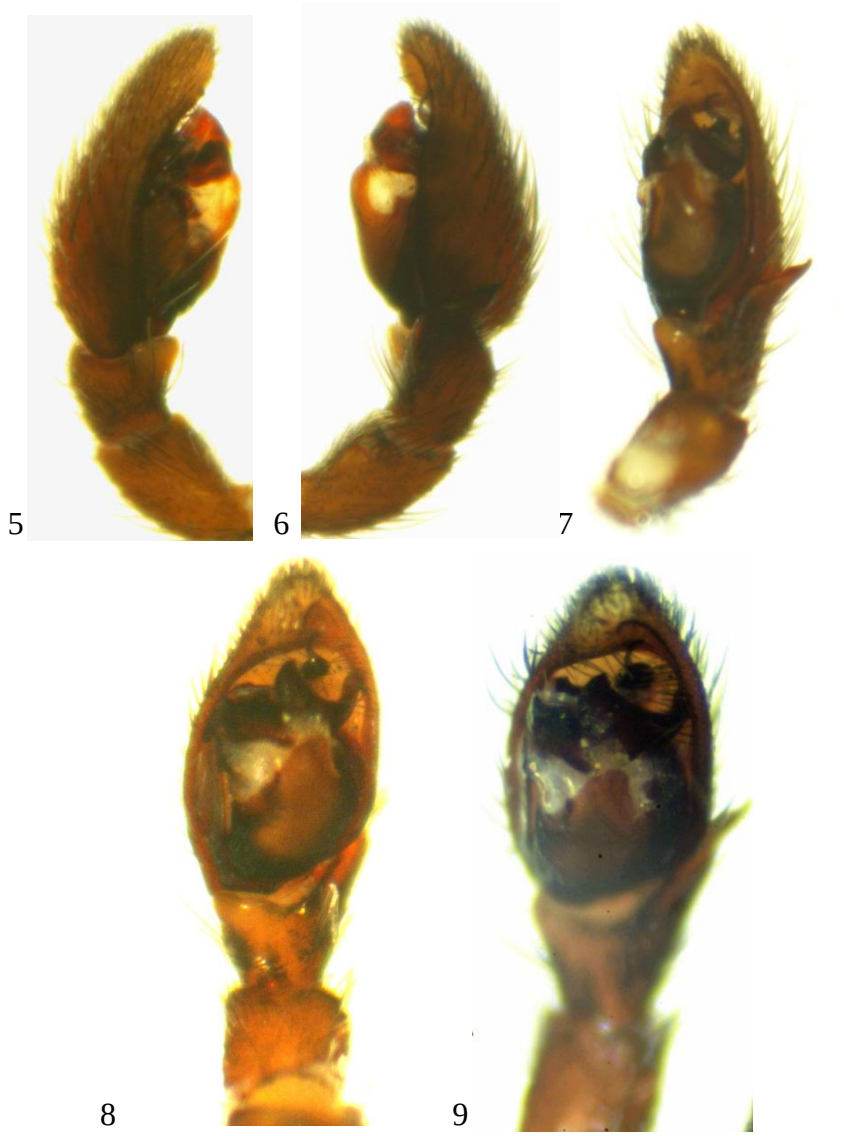
Melanophora tragica O. Pickard-Cambridge, 1872: 243, pl. 16, f. 22 (D♂).
♂ holotype from the Plains of Jordan, Palestine/Israel (HECO, B. 262, t. 63; reexamined by Levy, 1998).
Prosthesima tragica Simon, 1878: 98.
Zelotes tragicus Reimoser, 1919: 171; Bodenheimer, 1937: 243; Roewer, 1955: 459, Palästina; Bonnet, 1959: 4957, Palestine.
Zelotes tragicus Levy, 1998: 133-134, f. 82-85 (♂, D♀).
Zelotes tragicus FitzPatrick, 2007: 121, f. 81-84 (♂♀).

Material examined: 26♂♂, 38♀♀, Egypt, Ismailia governorate, Ismailia (about 30°29'27"N, 32°14'29"E, elevation 10 m). Coll. Gihan Sallam, Nahla Abd El-Azim & Hazem Abul Fadl, January-October 2019 (Table 1).
Male (Figs. 3,5-14)**:** TL 5.8, CL 3.0, CW 2.3, AL 2.8.
Female (Figs. 4,15-23)**:** TL 7.0, CL 2.8, CW 2.0, AL 4.2.
Description: See O. Pickard-Cambridge (1872) and Levy (1998).
Distribution: Chad, Ethiopia, Palestine/Israel (World Spider Catalog, 2020), Egypt "NEW RECORD".

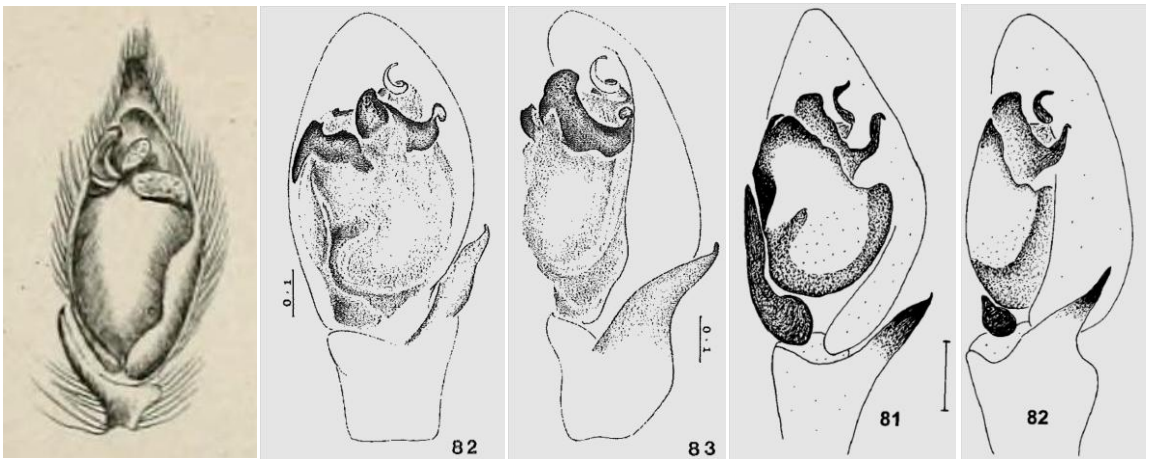
3

4

Figs. 3-4. *Zelotes tragicus* (O. Pickard-Cambridge, 1872), habitus, dorsal view.
3. ♂. 4. ♀.



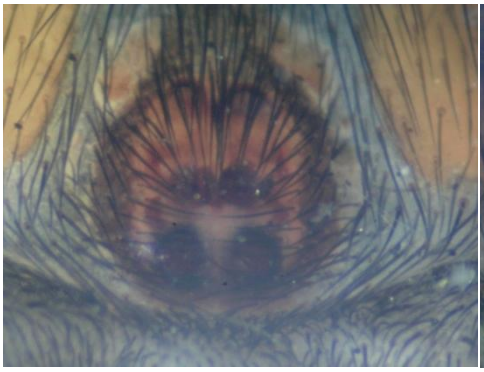
Figs. 5-14. *Zelotes tragicus* (O. Pickard-Cambridge, 1872), ♂ left palp.
5. prolateral view. 6. retrolateral view. 7. ventro-retrolateral view. 8-9. ventral view.

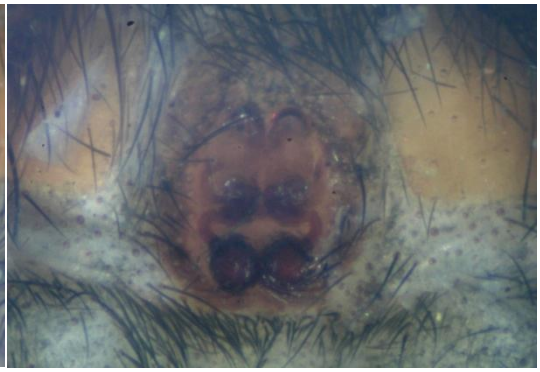


10 11 12 13 14

Figs. 10,11,13. ventral view. 12,14. retrolateral view. [10. after O. Pickard-Cambridge (1872): pl. 16, fig. 22; 11-12. after Levy (1998): figs. 82-83; 13-14. after FitzPatrick (2007): figs. 81-82]

15

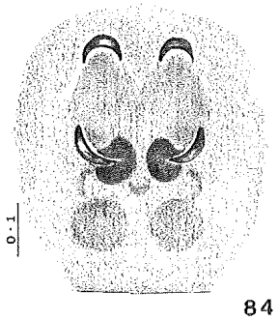




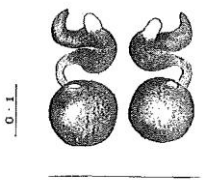
16 17

18 19

Figs. 15-23. *Zelotes tragicus* (O. Pickard-Cambridge, 1872), ♀. 15-18. Epigynum, ventral view. 15,17. hairs partly removed. 19. Spermathecae, dorsal view. 18-19. cleared.

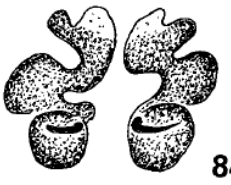


84



85

83



84

20 21 22 23

Figs. 20,22. Epigynum, ventral view. 21,23. Spermathecae, dorsal view.
[20-21. after Levy (1998): figs. 84-85; 22-23. after FitzPatrick (2007): figs. 83-84]

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Segestria florentina (Rossi, 1790) in Jordan (Araneae: Segestriidae), with a list of the known records of spiders from Jordan

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Abstract

Family Segestriidae is recorded here for the first time from Jordan with both genus *Segestria* and the species *Segestria florentina* (Rossi, 1790). The available material is only one male found in Petra, south of Jordan in October 1984. Its illustrations and measurements are presented.

The records of spider species in Jordan are sporadic and there is no list of species until now. Therefore, the available records of spider species of Jordan are here collected with their references and localities. The list includes 13 Families, 24 genera, and 28 species of spiders in Jordan.

Keywords: Araneae, Segestriidae, *Segestria florentina*, Jordan.

Introduction

Petra, from Ancient Greek: Πέτρα = Rock, is a historic and archaeological city in southern Jordan. The area around Petra has been inhabited from as early as 7000 BC, and the Nabataeans might have settled in what would become the capital city of their kingdom, as early as the 4th century BC. However, archaeological work has only discovered evidence of Nabataean presence dating back to the second century BC, by which time Petra had become their capital. The Nabataeans were nomadic Arabs who invested in Petra's proximity to the trade routes by establishing it as a major regional trading hub (Wikipedia, 2020: Petra) (Fig. 1).

When I visited Petra in October 1984, in a tour, I could find a small hole about 10 mm diameter in a wall inside a rock-cut building of one of the rock graves in the street of

facades (The Urn Tomb ?) (Fig. 2). The entrance of the hole had silk threads denoted to the presence of a silk tube inside the wall. I could pull the tube quickly using a forceps to get the spider inhabitant. Many years later, the alcohol evaporated but I could identify it to find that it is a male *Segestria florentina* (Rossi, 1790); a species that is not yet recorded from Jordan. Also, its family Segestriidae is not recorded too from Jordan.

Fig. 1. Distribution map of *Segestria florentina* (Rossi, 1790) in Jordan. Red circle = Petra. (Map after NordNordWest/Wikipedia)

Fig. 2. Rock graves in the street of facades in Petra, Jordan where *Segestria florentina* (Rossi, 1790) was collected.

Family Segestriidae Simon, 1893 is a small family of 4 genera, 135 species and 1 subspecies. Genus *Segestria* Latreille, 1804 [The type genus] includes 21 species and 1 subspecies distributed in Europe, northern Africa, Madagascar, Mediterranean, Asia, New Zealand, North and South America (World Spider Catalog, 2020). The type species of Segestriidae is *Segestria florentina* (Rossi, 1790) described as *Aranea florentina* by Petrus Rossius (Rossi, 1790: 133) from Florence, Italy.

Fig. 3. *Segestria florentina* (Rossi, 1790) ♂ from Petra, habitus, dorsal view.

Segestriid spiders are easily recognized by their most remarkable character: three leg pairs directed forward, instead of two (Fig. 3). They are called "Tubeweb spiders" because their webs, made of non-sticky silk, are radiating from holes in substrate (Jocqué & Dippenaar-Schoeman, 2006).

Diagnostic and descriptive characters of Segestriidae

Medium-sized araneomorph spiders (5-16 mm); ecribellate; haplogyne; with six eyes, in two rows; endites longer than wide; leg with three tarsal claws; legs I-III directed forwards (Fig. 3); tibiae and metatarsi I with double row of spines ventrally; legs III and IV short and stout in *Ariadna*, longer and more slender in *Segestria*; leg IV with numerous spines in *Segestria*; abdomen longer than wide, cylindrical; hirsute; without

pattern, or with pattern consisting of dark, median, longitudinal stripes in *Segestria*; with two booklungs and a second pair of anteriorly positioned tracheae opening through distinct spiracles situated behind epigastric groove; colulus fairly large and furnished with setae; male palp with bulbus simple, inserted over most of basal third of tarsi (*Segestria*); embolus varies from elongated (*Segestria*) (Figs. 4-5) to short (*Ariadna*) (Figs. 4-5) (Dippenaar-Schoeman & Jocqué, 1997; Jocqué & Dippenaar-Schoeman, 2006; Murphy & Roberts, 2015; El-Hennawy, 2020).

Abbreviations used: AL = abdomen length, CL = carapace length, CW = carapace width, TL = total length. Collections: ACE = Arachnid Collection of Egypt; BMNH = Natural History Museum, London; CRB = Robert Bosmans personal collection, Ghent; SMF = Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt; ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn.

All measurements are in millimetres (mm).

Family **Segestriidae** Simon, 1893
Genus ***Segestria*** Latreille, 1804
Segestria florentina (Rossi, 1790)
Figs. 3-5.

World Distribution: Europe, northern Africa, Turkey, Georgia. Introduced to Brazil, Uruguay, Argentina (World Spider Catalog, 2020).

Europe & northern Africa in detail (Nentwig *et al.*, 2020):

Europe: Andorra, Belgium, Bulgaria, Croatia, Cyprus, France [+ Corsica], Georgia, Germany, Greece [+ Crete], Hungary, Ireland, Italy [+ Sardinia], Sicily, Montenegro, Netherlands, North Macedonia, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain [+ Balearic Islands], Switzerland, Turkey (Asia), Ukraine, United Kingdom.

North Africa: Morocco, Algeria, Tunisia, Egypt (Bosmans, unpubl.).

Material examined. Jordan, Petra 1♂ (about (30º19'40"N, 35º26'57"E, elev. 810 m), 31 October 1984, found in its tube web inside the wall of a rock-cut building, leg. Hisham K. El-Hennawy [ACE.1984.10.31.AR.001.JOR].

4   5

Figs. 4-5. *Segestria florentina* (Rossi, 1790), male palp. 4. prolateral view.
5. retrolateral view.

For the description of *S. florentina* see Brignoli (1976) and Giroti & Brescovit (2011) who redescribed it from South America, in detail. For its synonyms see World Spider

Catalog (2020). The most recent publication on this species is that of El-Hennawy (2020) from Egypt.
♂ habitus, dorsal view (Fig. 3).

Measurements (restored dry specimen):
♂ TL 9.8, CL 6.1, CW 3.5 (thoracic region), AL 3.5.

Table 1. Measurements of leg segments of *Segestria florentina* (♂).

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	5.4	2.0	5.7	6.0	1.5	20.6
II	4.8	2.0	6.0	5.6	1.8	20.2
III	5.5	2.0	5.5	5.0	1.5	19.5
IV	5.0	1.9	6.0	4.8	1.3	19.0

Male palpal organ see Figs. (4-5).

Tubeweb and behaviour

Segestriids make a tubular, silk-lined retreat in a variety of situations: in rocks, walls, holes in bark, and branches. Silk lines radiate from the opening of the retreat and alert the spider to potential prey (Murphy & Roberts, 2015: 152). Vibrations transmitted to the spider via the trip-lines (silk threads) betray the presence of prey. In *Segestria* the opening of the tube is provided with a wide collar of regular white silk at the mouth. The spider waits in the entrance of the tube, with six legs stretched forward (Dippenaar-Schoeman & Jocqué, 1997: 271, 273) (El-Hennawy, 2020).

Spider species of Jordan according to known records

The records of spider species in Jordan are sporadic and there is no list of species until now. The available records of spider species of Jordan are collected below with their localities. The result is: 13 Families, 24 genera, 28 species.

Family **Eresidae** C.L. Koch, 1845

Stegodyphus lineatus (Latreille, 1817)

- El-Hennawy (1987: 18): The Shaumari Wildlife Reserve near Azraq Oasis and Tabarboor (Amman).
- Kraus & Kraus (1989: 234): Jordan: Ou Ritama, Shishan (1♀ BMNH 1965.7.14.3; leg. Jordan Exped. 1965 MOUNTFORT/HOSKING). - Wadi Hasa, 30 km S Kerak (2♀; HORAK leg. 18.VI.1983). - 5 km N Tafila (4♀ 1♀ juv.; HORAK leg. 15.VI.I983.

Stegodyphus pacificus Pocock, 1900

- El-Hennawy (1991: 93-94): Azraq El-Drooz or the northern Azraq, in Azraq Oasis.

Family **Gnaphosidae** Pocock, 1898

Haplodrassus mediterraneus Levy, 2004

- Bosmans *et al.* (2018: 59): Material examined. JORDAN, Al Karak: Sjhawbak castle (N30°31’56” E35°33’39”), 1♂, stones on slope to the castle, 17.XI.2007, R. Bosmans leg. (CRB), Madaba: El Alia aeroport W. (N31°43'21” E35°59'5”), 1♂, under stones, 12.XI.2007, R. Bosmans leg. (CRB). [First record in Jordan].

Pterotricha dalmasi Fage, 1929

- Levy (1995: 950): Jordan: near Ma'an.

Zelotes scrutatus (O. P. Cambridge, 1872)

• Bosselaers (1999: 106): 1♀ Jordan, Aqaba governorate, Wadi Rum, 21 km NE of Aqaba, elev. 700 m, N29°37'20" E35°11'14".

Family **Linyphiidae** Blackwall, 1859

Alioranus pastoralis (O. Pickard-Cambridge, 1872)

• Tanasevitch (2011: 51): 1♂, Jordan, Wadi Schaib, 15.III.1968, leg. J. & S. Klapperich. [First record in Jordan].

Family **Lycosidae** Sundevall, 1833

Evippa praelongipes (O. Pickard-Cambridge, 1870)

• Bosselaers (1999: 106): 1♀, 1 juvenile. Jordan, Aqaba governorate, Wadi Rum, 21 km NE of Aqaba, elev. 700 m, N29°37'20" E35°11'14".

Family **Oecobiidae** Blackwall, 1862

Oecobius cellariorum (Dugès, 1836)

• Bosselaers (1999: 106): 1♀ Jordan, Aqaba governorate, Wadi Rum, 21 km NE of Aqaba, elev. 700 m, N29°37'20" E35°11'14".

• El-Hennawy (2011: 4 (1♂); 2018: 13 (1♀)): Amman.

Uroctea hashemitorum Bosselaers, 1999

• Bosselaers (1999: 105): Jordan, Aqaba governorate, Wadi Rum, 21 km NE of Aqaba, elev. 700 m, N29°37'20" E35°11'14".

Family **Oxyopidae** Thorell, 1870

Oxyopes elifaz Levy, 2007

• Levy (2007: 13): Israel and Jordan: on sands along the southern Arava Valley. Records: East of Yahel, Lotan, Qetura and Elifaz.

Family **Pholcidae** C.L. Koch, 1850

Artema nephilit Aharon, Huber & Gavish-Regev, 2017

• Aharon, Huber & Gavish-Regev (2017: 22): JORDAN: Aqaba Province: 2♂♂, Wadi Rām (29.7405°N, 35.4574°E), among rocks, 830 m a.s.l., 12 Sep. 2013, B.A. Huber leg. (ZFMK Ar 16161-62), collected as juveniles, molted to adults in Dec. 2015 and Sep. 2016. – Ma'an Province: 2♂♂, 2♀♀, Petra (30.324°N, 35.447°E), 900–950 m a.s.l., rock-cut tombs, near theater, 13 Sep. 2013, B.A. Huber leg. (ZFMK Ar 15227); 1♀, 1 juv., in pure ethanol, same data (ZFMK Isr 36); 1♂, same data but among rocks (ZFMK Ar 15228). – Karak Province: 1♀, 1 juv., Wadi Hasa (31.004°–31.014°N, 35.494–35.506°E), -330 to -250 m b.s.l., among rocks, 14 Sep. 2013, B.A. Huber leg. (ZFMK Ar 15229–30); 1♀, in pure ethanol, same data (ZFMK Isr 63). – Madaba Province: 1♂, 1 juv., Wadi Mujib (31.465°N, 35.578°E), -380 m b.s.l., among rocks, 14 Sep. 2013, B.A. Huber leg. ZFMK (Ar 15231).

Hoplopholcus cecconii Kulczyński, 1908

• Huber (2020: 68): JORDAN, Irbid: 2♂ 5♀, ZFMK (Ar 20965), Barkash [=Bergesh] Natural Reserve, Barkash Cave [~32.437°N, 35.744°E], vii.2007 (J. Wunderlich).

Family **Salticidae** Blackwall, 1841

Aelurillus gershomi Prószyński, 2000

• Metzner (2020): Dana Village 15.4.2004 (SMF-57073-141).

Aelurillus nabataeus Prószyński, 2003

- Metzner (2020): above Dana Village 17.4.2004. Dana Nature Reserve, Wadi Dana, 16.4.2004, (SMF-57075-141).

Cyrba algerina (Lucas, 1846)

- Metzner (2020): Dana Nature Reserve, Wadi Dana 16.4.2004 (SMF-57028-141), Prov. Ma´an, NW Ma´an, Wadi Musa, Petra [Batra´] Valley, 17.3.1977, (SMF-65189-141).

Heliophanillus fulgens (O. Pickard-Cambridge, 1872)

- Metzner (2020): Jordan.

Menemerus davidi Prószyński & Wesołowska, 1999

- Metzner (2020): N-Amman, Wadi Azab, (SMF-65144-141).

Mogrus logunovi Prószyński, 2000

- Prószyński (2000: 255; 2003: 101): Jordan: Wadi Ram.
- Metzner (2020): Wadi Rumm [Wadi Ramm], 9.4.2004, (SMF-57030-141).

Mogrus mirabilis Wesołowska & van Harten, 1994

- Metzner (2020): Jordan.

Philaeus chrysops (Poda, 1761)

- Metzner (2020): Dana Nature Reserve, Wadi Dana, 16.4.2004, (SMF-57029-141).

Synageles dalmaticus (Keyserling, 1863)

- Metzner (2020): 20 km NW Amman, Fuheis, (SMF-65308-141).

Family **Scytodidae** Blackwall, 1864

Scytodes kinzelbachi Wunderlich, 1995

- Wunderlich (1995b: 621): Jordanien, Azraq E Amman, an einer Lache in einem Salzbecken, Holotypus ♂ und 1 juv. (Paratypus), R. KINZELBACH leg. 24.III.1979, SMF.
- Gasparo (2003: 13): 1♂ 1♀, Giordania, sorgente presso Dawa 30 km a sud di Tafila, 1200 m, 25.III.1987, M. Zapparoli leg. (Coll. Museo di Zoologia dell'università degli Studi "La Sapienza" di Roma - tubo Aran. 236).

Family **Sparassidae** Bertkau,1872

Cerbalus aravaensis Levy, 2007

- Levy (2007: 17): Israel and Jordan, at the conterminous southern Arava Valley. Records: Jordan: West Wadi Sik (709433/326944), Rahma (704084/314071), Qatar area (704388/306210; 702650/306079).

Family **Theraphosidae** Thorell, 1869

Chaetopelma olivaceum (C.L. Koch, 1841)

- Guadanucci & Gallon (2008: 38): JORDAN: Amman: 1♂ (BMNH) J.B. Philly, 3–19.X.1924.
- Gallon, Gabriel & Tansley (2012: 137): JORDAN: BMNH 1924.10.3.19, 1♂, Amman, Transjordania, December 1911 (Lt. Sr. J. B. Philly, Dr L. H. Gough, SS Flower).

Family **Theridiidae** Sundevall, 1833

Latrodectus pallidus O. Pickard-Cambridge, 1872

- El-Hennawy (2006: 29): 1♀ "near Abu Nusseir, Amman (Jordan) on 1st November 1988".

Family **Zodariidae** Thorell, 1881

Pax meadei (O. Pickard-Cambridge, 1872)

• Jocqué (1991: 84): Other Material Examined: 1♂ 1♀: Jordan, Waad al Haasa, S Dhiban, Kings Road, 16.III.1977, R. Kinzelbach (SMF).

Zodarion lutipes (O. Pickard-Cambridge, 1872)

• Bosmans (2009: 282): JORDAN. Ajlun: Zjlun E., 3♀, stones in *Pinus* forest, 19.XI.2007 (CRB). Al Karak: Shawbak castle, 3♂ 2♀, stones on slopes to the castle, 17.XI.2007 (CRB). At-Tafila: Dhana village, 1♂ 1♀, litter in flooded gardens, 17.XI.2007 (CRB).

Zodarion nitidum (Savigny, 1825)

• Levy (1992: 88): Jordan (Amman).

Doubtful Records

O. Pickard-Cambridge (1872) described species from the "plains of the Jordan" meaning "Jordan River". He collected his specimens west of the river, inside Palestine not the Kingdom of Jordan as we know today. Therefore, all records depended on "plains of the Jordan" as the country of Jordan are excluded. Also, there are other excluded wrong records as follows:

Family **Gnaphosidae** Pocock, 1898

Gnaphosa bithynica Kulczyński, 1903

The four references in the World Spider Catalog (2020) do not include any record from Jordan!

Family **Oecobiidae** Blackwall, 1862

Oecobius affinis O. Pickard-Cambridge, 1872

Pickard-Cambridge (1872: 222) described this species only from Lebanon not Syria and Jordan as in the World Spider Catalog (2020).

Wunderlich (1995a: 590) said that the examined material of Pickard-Cambridge is from "Jordanien, Hasbeija"! [Hasbeiya is in Lebanon.]

Oecobius trimaculatus O. Pickard-Cambridge, 1872

Pickard-Cambridge (1872: 220) described this species only from the plains of the Jordan not Jordan as in the World Spider Catalog (2020).

Wunderlich (1995a: 599) considered "the plains of the Jordan" = Jordan.

Family **Salticidae** Blackwall, 1841

Heliophanus edentulus Simon, 1871

Metzner (2020): Jordan: Kelebek mountains, between Avas and Esimi, (SMF-65145-141). [GREECE ?]

Phlegra fasciata (Hahn, 1826)

Metzner (2020): Jordan: Kelebek mountains, between Avas and Esimi, (SMF-65147-141). [GREECE ?]

Pseudeuophrys obsoleta (Simon, 1868)

Metzner (2020): Jordan: Kelebek mountains, between Avas and Esimi, (SMF-65146-141). [GREECE ?]

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